WEATHER CHARTS

OF

THE BAY OF BENGAL

AND

ADJACENT SEA NORTH OF THE EQUATOR.

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THE BAY OF BENGAL

AND

ADJACENT SEA NORTH OF THE EQUATOR

SHEWING THE

Mean Pressure, Winds and Currents in each month of the year.

PUBLISHED BY ORDER OF HIS EXCELLENCY THE VICEROY AND GOVERNOR GENERAL OF INDIA, IN COUNCIL

BY

THE METEOROLOGICAL DEPARTMENT OF THE GOVERNMENT OF INDIA.

ADVERTISEMENT.

THE volume herewith issued is the first instalment of a series of charts illustrative of the Meteorology of the North Indian Ocean. The data from which they have been drawn up are those collected by London Meteorological Office from ships, furnished with duly verified instruments, and relating to the years 1855 to 1878. They are similar in kind to those utilized in the Marine publications of the London Office, and have been extracted from the original log-books, corrected and tabulated in data books, according to geographical position, in that Office, under the superintendence of the Officers of the Department, at the cost of the Indian Government.

The further reduction and discussion and the preparation of the charts has been carried out by the Meteorological Department of the Government of India, under the immediate superintendence of Mr. W. L. Dallas. The present series of charts gives for each month the distribution of pressure, the winds and the Marine currents of the Bay of Bengal and the adjacent portion of the North Indian Ocean, between the limits of E. long. 80° and 100°, the Asiatic coast and the equator. These will be followed by a similar series illustrative of the Arabian Sea and the remainder of the North Indian Ocean, the preparation of which is now well advanced towards completion. And the temperature of the atmosphere and sea water, in both areas, will be shewn in a subsequent publication.

HENRY F. BLANFORD,
Meteorological Reporter, Government of India.

SIMLA,
The 25th October 1886.

METEOROLOGY OF THE BAY OF BENGAL.

PREFATORY NOTE.

THE discussion and reduction of the marine observations, recorded over the Bay of Bengal between the years 1855 and 1878, which were received from the London Meteorological Office in November 1880, were taken in hand in the spring of 1883, and the whole of the barometric, wind and ocean-current data for the 12 months have now been prepared for publication.

Barometric Data.—In general, the methods, adopted by the London Meteorological Office in discussing corresponding data for the seas adjacent to the Cape of Good Hope, have been followed in the preparation of the present charts. It has been considered better, however, to show the distribution of pressure by means of "isobars" than by the curves of "relative frequency" given on the Cape charts; and having regard to the inequality of the number of observations in different parts of the Bay, it was decided not to trust to the variation of the hours of observation neutralizing the daily range, but to correct each observation to the mean of the day. Tables of correction for the different hours were constructed, and these corrections, in the form of curves of diurnal range, are shown on the side of the chart.

Wind-Roses.—With a view to greater simplicity, it was also decided to adopt a form of wind-rose, in which the length of the radiants should represent the percentage of wind frequency, and the numerals attached its average force, in place of the more elaborate wind-roses of the Cape work. In the wind-roses on the following charts the length of any given radiant from the large fiducial circle indicates the relative frequency of the wind *from* the quarter *towards* which it points, in terms of a percentage of the whole number of recorded observations; and the *diameter* of the small shaded central circle is proportional to the percentage of calms and light variable winds. The scale, which is common to both the wind radiants and to the *diameters* of the circles of calms, is given in the right-hand upper corner of the chart. Where the percentage under any point does not equal 2·5 per cent. of the recorded winds, that point has been omitted, but the amount of the percentage appears in a table at the close of the remarks on the month. Except for cases in which the observations are too few to afford a trustworthy mean value, the average force of the wind from a given direction is shown by an Arabic numeral, (the number on Beaufort's scale,) at the outer end of the radiant; the Roman figures indicate the percentage of gales, as compared with the total number of winds from all points of the compass. The figures within the fiducial circle represent the number of observations on which the wind-rose is founded. The space to which each wind-rose refers is enclosed by thick rectangular lines. In order to determine the boundaries of these spaces, the percentages of each one degree square were first plotted at the centre of its square, and subsequently a number of these small squares, the winds of which presented similar characteristics, were grouped together, and the boundaries drawn accordingly. The result of the combination of these small wind-roses is that given in the chart.

Marine Currents.—The small black arrows show the actual observations of those currents which amounted to 15 miles a day or upwards. Lower rates of movement are omitted. The arrows fly with the currents; the length of each arrow showing the rate of the movement, according to the scale given in the right-hand upper corner of the chart.

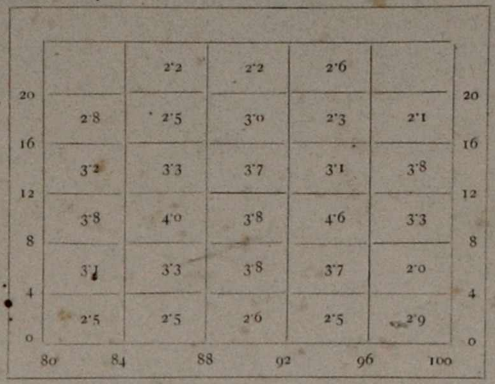
N.B.—In the following remarks, the word "north" in describing latitude and the word "east" in describing longitude have been omitted as unnecessary. *Latitude* always means "north latitude," and *longitude*, "longitude east of Greenwich."

JANUARY.

Barometric Pressure.—The distribution of atmospheric pressure, shown in the January chart, is founded on 5,556 observations of the barometer. These observations are, however, very unevenly distributed; seventy-seven per cent. having been recorded on the western, and only twenty-three per cent. on the eastern side of the meridian of 90°E. Large districts in the eastern half of the Bay are very inadequately represented and in some cases void of data, whereas in some parts of the western side the observations are very thickly crowded; especially is this the case over the head of the Bay, where the shipping tracks converge towards the mouth of the Hugli, and where in spaces of 1° square, there are over one hundred recorded observations. The mean pressure of January is the highest of the year, but, except at the head of the Bay, its excess over that of the next preceding and succeeding months is inconsiderable. The barometer is highest in the north of the Bay, where it marks slightly over 30·0 inches, and the pressure decreases slowly southward, down to two shallow areas of equal minimum pressure lying, the one off Sumatra, the other off the south-west coast of Ceylon. In these areas of minimum pressure, the average reading of the barometer, reduced to 32°, is a little below 29·9 inches.

Winds.—The average winds of the Bay are shown by wind-roses. Of these it was found necessary to construct 18, to exhibit plainly the slightly varying characteristics of different parts of the Bay. Eight of these have the point of maximum frequency at north-east; four at north-north-east; two each at north and north-north-west, and one each at north-west and east. It will be noticed that the northerly (north-north-west to north-north-east) winds, which are the prevailing winds at the land stations around the head of the Bay, extend to a considerable distance seaward; their influence being shown by the wind-roses Nos. 1 and 2; but it is also to be observed that, in the immediate neighbourhood of the coast, (wind-rose No. 1) winds from south-westerly quarters (sea-winds) are not infrequent, even in January. From lat. 18°, southward to the Equator in the western division of the Bay, and down to lat. 5° in the eastern division, the north-easterly winds of the winter monsoon (with variations to north and east) blow steadily and almost uninterruptedly. Over the south-eastern portion of the Bay to the west of Sumatra, however, the wind backs towards west, and in No. 17 the maximum frequency is from north-west. Both in Nos. 15 and 17 easterly winds are exceptional, and westerly winds varying through half the compass prevail almost exclusively. There is in this portion of the Bay, and generally to the south of lat. 5°, a very high percentage of calms.

The wind attains its maximum force between the parallels of 8° and 14° lat. Except in the middle of the Bay, to north and south of this band the force decreases; and the average force is low, both over the head of the Bay and in the neighbourhood of the Equator. The following diagram shows the average force of the wind irrespective of direction in different parts of the Bay:—



	80–84	84–88	88–92	92–96	96–100
20–		2·2	2·2	2·6	
16–20	2·8	2·5	3·0	2·3	2·1
12–16	3·2	3·3	3·7	3·1	3·8
8–12	3·8	4·0	3·8	4·6	3·3
4–8	3·1	3·3	3·8	3·7	2·0
0–4	2·5	2·5	2·6	2·5	2·9

Except in that part of the Bay lying to the northward of lat. 20°, the vertical strip, in which the average force of the wind is greatest, is that between long. 88° and long. 92°.

Gales.—The occasions on which the wind has risen to the force of a gale during this month are not numerous, though squalls of considerable strength are not infrequent in the latitude of Ceylon and Acheen Head. In the twenty years of recorded observations, only three gales of any importance are noticed; and of these, the only serious storm was in 1870.

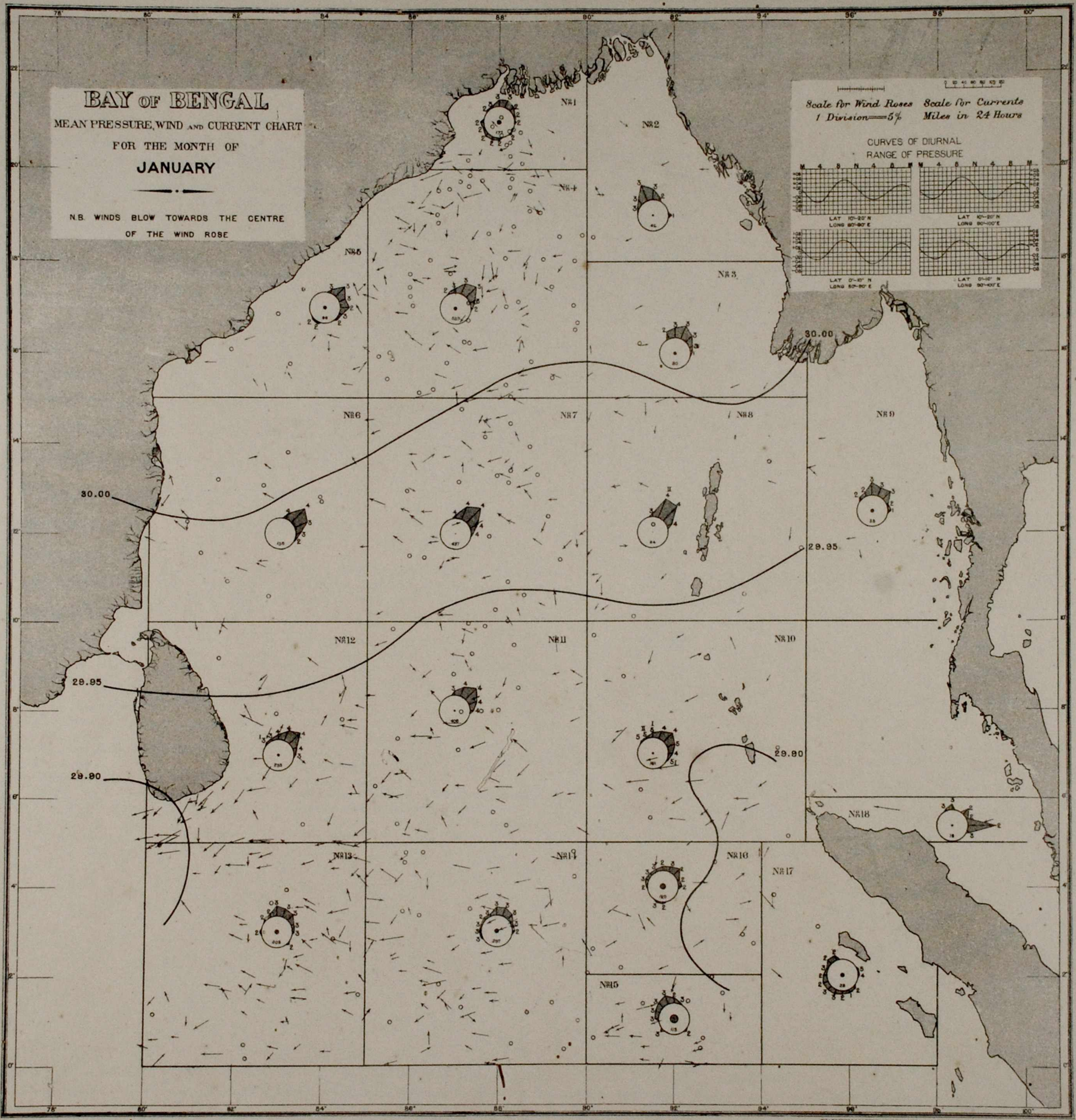
The following is the list of the gales of which a record has been found:—

1761—January 1st, Cyclone at Pondicherry.
1805— „ 7th, Gale felt at Trincomalee and on Coromandel Coast.
1859— „ 3—6th, Storm formed near Nicobars and travelled westward.
1860— „ 3—6th, Storm appeared off north-western coast of Sumatra; travelled north-westward to centre of the Bay.
1870— „ 10—13th Cyclone formed over south of Bay; travelled westward and north-westward.

Currents.—The recorded currents vary considerably in different parts of the Bay, though the main set is distinctly westerly. Round the south of Ceylon, there exists a strong and general current to the westward. This set is strongest between the lats. 4° and 6°, and decreases to the southward of 4°. There is apparently a slight outset from the Bay along the west coast of Sumatra in a south-east current, while along the Coromandel Coast there are indications, though very slight ones, of the north-west current, which, in succeeding months, becomes so prominent. In the upper part of the Bay, between long. 85° and 90°, the current is very complicated, a north-west set existing apparently on the western side of that area, and a southerly set on the eastern side.

The following figures give in tabular form the information shown graphically on the wind-roses of the chart. The upper line of figures are the percentage proportion of the wind, the lower the forces in integers and decimals on Beaufort's scale:—

Number of wind-rose.	Percentages.																
	N.	NNE.	NE.	ENE.	E.	ESE.	SE.	SSE.	S.	SSW.	SW.	WSW.	W.	WNW.	NW.	NNW.	Calms, &c.
1	13·9 2·6	15·7 2·6	11·5 2·1	3·7 1·0	4·3 1·9	1·4 1·6	3·1 1·5	0·5 1·3	4·8 1·9	6·3 2·2	7·1 1·8	3·3 1·7	6·9 2·1	2·2 1·9	2·9 1·8	3·1 2·7	9·3
2	21·9 2·6	7·0 2·0	2·4 2·0	... ...	7·1 1·0	... ...	... ...	... ...	2·2 3·0	2·4 4·0	... ...	1·8 2·0	1·8 2·5	3·8 2·8	11·9 3·1	34·3 2·8	3·4
3	20·2 2·9	27·1 2·7	18·8 3·3	6·9 3·4	2·5 1·0	... ...	... ...	... ...	... ...	1·3 2·0	0·6 3·0	1·9 2·5	... ...	... ...	0·8 1·5	15·0 2·3	4·9
4	8·9 2·8	23·9 3·1	29·7 3·2	11·2 2·9	4·0 2·3	2·2 2·7	1·2 2·1	0·5 1·9	2·3 1·9	2·0 2·7	1·9 2·0	0·9 2·2	0·7 2·0	0·7 2·6	0·7 2·1	2·8 2·4	6·4
5	1·5 1·7	8·5 3·4	27·1 2·9	14·0 3·1	19·8 2·4	5·3 2·5	4·2 1·9	1·0 2·0	1·0 2·0	4·8 2·0	2·9 2·2	... ...	1·9 2·5	0·2 2·0	... ...	1·6 1·5	6·2
6	1·6 3·7	12·5 4·1	39·2 3·9	28·3 3·4	9·9 2·9	2·8 1·7	1·1 2·3	0·2 2·0	1·5 3·0	2·1 3·3	0·6 4·0	... ...	... ...	... ...	... ...	0·2 1·0	...
7	6·0 3·9	28·3 4·0	41·7 3·8	17·1 4·1	2·9 4·0	0·8 4·3	0·7 3·8	0·3 3·0	0·2 1·8	0·1 2·0	0·2 3·0	... ...	0·1 1·0	0·1 1·8	0·1 1·0	0·2 2·7	1·2
8	5·3 3·4	40·9 3·8	40·8 3·9	10·7 4·2	0·7 3·5	0·3 2·0	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	0·6 2·0	0·3 1·0	0·4
9	25·2 3·2	17·5 2·9	22·8 3·3	3·3 2·0	6·4 3·7	1·3 1·0	... ...	... ...	... ...	... ...	... ...	... ...	1·3 1·0	0·7 2·0	5·3 1·5	8·3 2·1	7·9
10	10·2 4·7	16·6 3·9	25·6 4·3	16·9 4·5	9·5 3·7	2·6 4·6	0·6 1·5	0·7 2·7	1·2 3·3	0·6 2·0	2·1 5·9	1·7 5·3	2·0 4·2	0·3 6·0	3·2 4·8	4·6 4·8	1·6
11	9·3 3·2	20·9 3·8	32·2 3·9	17·5 4·1	6·5 4·0	1·9 3·1	0·7 2·3	1·0 2·8	0·3 2·6	0·6 3·1	0·9 4·0	0·7 4·3	1·8 3·5	0·8 2·6	1·2 3·9	1·8 2·9	1·9
12	10·8 3·8	20·7 3·7	31·1 3·8	9·3 3·7	3·6 3·3	1·9 2·8	1·4 2·2	1·9 2·8	2·2 2·0	0·3 2·0	1·1 2·3	0·7 2·8	1·5 2·1	0·8 2·2	3·8 3·4	4·8 2·7	4·1
13	20·9 2·9	18·1 3·4	15·8 3·1	5·9 2·6	4·3 2·5	1·8 2·7	3·2 1·8	1·5 1·5	1·9 1·6	1·3 1·9	1·1 1·6	0·7 3·0	2·5 2·0	2·2 2·1	3·8 2·4	5·6 2·4	9·4
14	16·6 2·8	19·2 3·1	14·8 3·2	4·8 2·8	5·3 2·4	0·6 1·9	1·7 1·9	1·4 2·4	2·3 2·4	2·4 2·2	2·0 2·6	2·7 2·6	4·5 3·0	2·6 2·6	5·2 2·4	4·6 2·7	9·3
15	10·2 2·2	2·7 2·7	1·6 1·5	0·6 1·0	0·3 4·0	0·4 2·5	2·6 2·3	2·1 2·0	1·1 1·0	2·0 2·7	7·2 2·9	1·6 2·8	8·1 3·2	10·9 2·9	14·2 2·8	18·2 2·9	16·2
16	9·7 2·1	11·5 2·7	17·8 2·3	4·9 2·2	7·3 2·4	1·5 4·0	2·0 2·6	2·4 2·3	3·6 2·4	2·9 2·5	2·0 1·7	1·9 3·0	3·0 2·4	6·3 2·9	5·8 3·4	5·8 3·0	11·6
17	0·9 1·0	... ...	0·9 1·0	3·6 5·0	2·7 4·0	1·2 2·0	5·4 2·3	6·3 1·0	6·0 2·0	9·5 2·9	10·4 3·0	11·5 2·0	7·1 2·2	3·3 3·3	11·7 1·8	10·7 1·8	8·8
18	11·5 2·5	... ...	15·4 2·3	2·6 2·0	57·1 1·5	5·8 3·0	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	3·8 3·0	3·8



BAY OF BENGAL

MEAN PRESSURE, WIND AND CURRENT CHART
FOR THE MONTH OF
JANUARY

N.B. WINDS BLOW TOWARDS THE CENTRE
OF THE WIND ROSE

Compiled by W. L. Dallas.

PUBLISHED BY THE METEOROLOGICAL DEPARTMENT OF THE GOVT. OF INDIA.

PHOTOZINCOGRAPHED AT THE SURVEY OF INDIA OFFICES, CALCUTTA, FEBRUARY [illegible]

METEOROLOGY OF THE BAY OF BENGAL.

FEBRUARY.

Barometric Pressure.—The disproportionate excess of information on the western, as compared with that on the eastern, half of the Bay is just as pronounced in this as in the preceding month, but the total number of observations is slightly greater, *viz.*, 5,679.

The chart shows that, as compared with January, a slight barometric fall has occurred over the head and centre of the Bay, while in the south pressure is the same or even slightly higher. The isobar 30·0 ins., which in January stretched across the central portions of the Bay, has receded northward and now lies over the coast in the extreme North-East and North-West. At the same time the low pressure area, which in January lay off the south of Ceylon, has either disappeared or moved eastward, and amalgamated with that near Sumatra, which in the present chart extends as far West as Long. 85°. The retreat northward of the area of highest pressure (as shown by the isobar 30·0 ins.), combined with the fact that the position and value of the area of lowest pressure remains but little altered, has reduced the barometric gradient between the North and South of the Bay; but it will be noticed that this reduction of gradient is confined almost entirely to the northern half of the Bay, the relative positions of the lines 29·90 ins. and 29·95 ins. in the two months being very similar. Over the head and Western Districts of the Bay pressure is very uniform. Both in the isobar 29·95 ins., and in that of 29·90 ins., a "dip" to the southward occurs in about Long. 94°—a distribution which seems to be accompanied by a slight excess of northerly winds.

Winds.—The winds are illustrated by 20 wind-roses distributed over the surface of the Bay. As compared with those of January, they exhibit two features of difference. There is a general decrease in the average force and an increase in the percentage of calms, and at the same time a distinct shifting of winds from between N.E. and E. to S.E., S., S.W. and W.; in other words, there is a general tendency of the wind all over the Bay to veer somewhat. Classifying the wind-roses in the same manner as in January, it appears that 5 have the point of maximum frequency at N., 3 at N.N.E., 7 at N.E., 3 at S.W., and in 2 calms predominate. Even this rough analysis shows the decrease in the percentages under N.E. and N. N. E. directions, but the figures summing up the data of all the wind-roses and expressing the mean percentages for the whole Bay exhibit this change most plainly. The following are the percentages reduced to eight points derived from the table given below, those for January being added for comparison:—

	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calms, &c.
January	23	34	14	3	3	4	4	9	6
February	22	30	11	5	4	6	5	9	8

Another very important feature is the increase over the head of the Bay of south-westerly (sea-winds) winds (to which attention was directed in the preceding chart), and their very considerable extension southward towards the centre of the Bay. The consequence is that the south-westerly percentages, which in the wind-roses Nos. 1, 2, 3, 4 and 5 in January were hardly appreciable, have become in the wind-roses Nos. 1, 2, 3 and 4 of February one of the most important characteristics.

With these exceptions, the main features of the wind-circulation agree very fairly with those of January. Between Lat. 3° and Lat. 15° the north-east monsoon (with variations between N. and E.) is very decidedly the prevailing wind, but that part of the Bay north of Lat. 15° and the sea between the Equator and Lat. 3° present other features. Wind-rose No. 1 shows a very uniform percentage for all points of the compass with a slight maximum under S.W.; No. 2 also shows a very slight south-westerly preponderance with an almost entire absence of winds between N.N.E. through N. to W.S.W.; while No. 3, like No. 1, has the winds from all directions in nearly equal proportions with an insignificant maximum under S.W.; No. 4 shows the northerly (N.E. to N.W.) and south-westerly (S. to W.) winds prevailing with fairly equal frequency and a practical absence of winds from other quarters. In the Equatorial sea to the south of the Bay the wind backs from N.E. towards North and North-West, and both in No. 19 and No. 20 the points of maximum frequency are to the West of North. In this region and particularly over the sea to the west of Sumatra the percentage of calms is high.

Force.—As was noticed above, the general force of the wind over the Bay during February is less than during January. The following table shows the mean force of winds from all directions for spaces of 4° square.

	80	84	88	92	96	100
		2·5	2·0	1·8		
20	2·3	2·4	2·3	2·7	1·6	20
16	2·3	2·3	2·5	2·6	2·7	16
12	3·3	3·7	3·3	2·8	—	12
8	2·9	3·1	3·0	2·0	2·2	8
4	2·8	2·4	2·7	1·8	—	4
0	80	84	88	92	96	100

The mean force of the wind is greatest with the wind from N.E. and least from S.E.; the wind-rose with the highest average force is No. 10 containing 39% of north-easterly winds.

Gales.—High winds are extremely rare during this month. In 1872 a slight gale was experienced by one ship in the extreme N.W. corner of the Bay, and in 1859 and 1863 unimportant gales were felt near the Equator between Long. 84° and 88°.

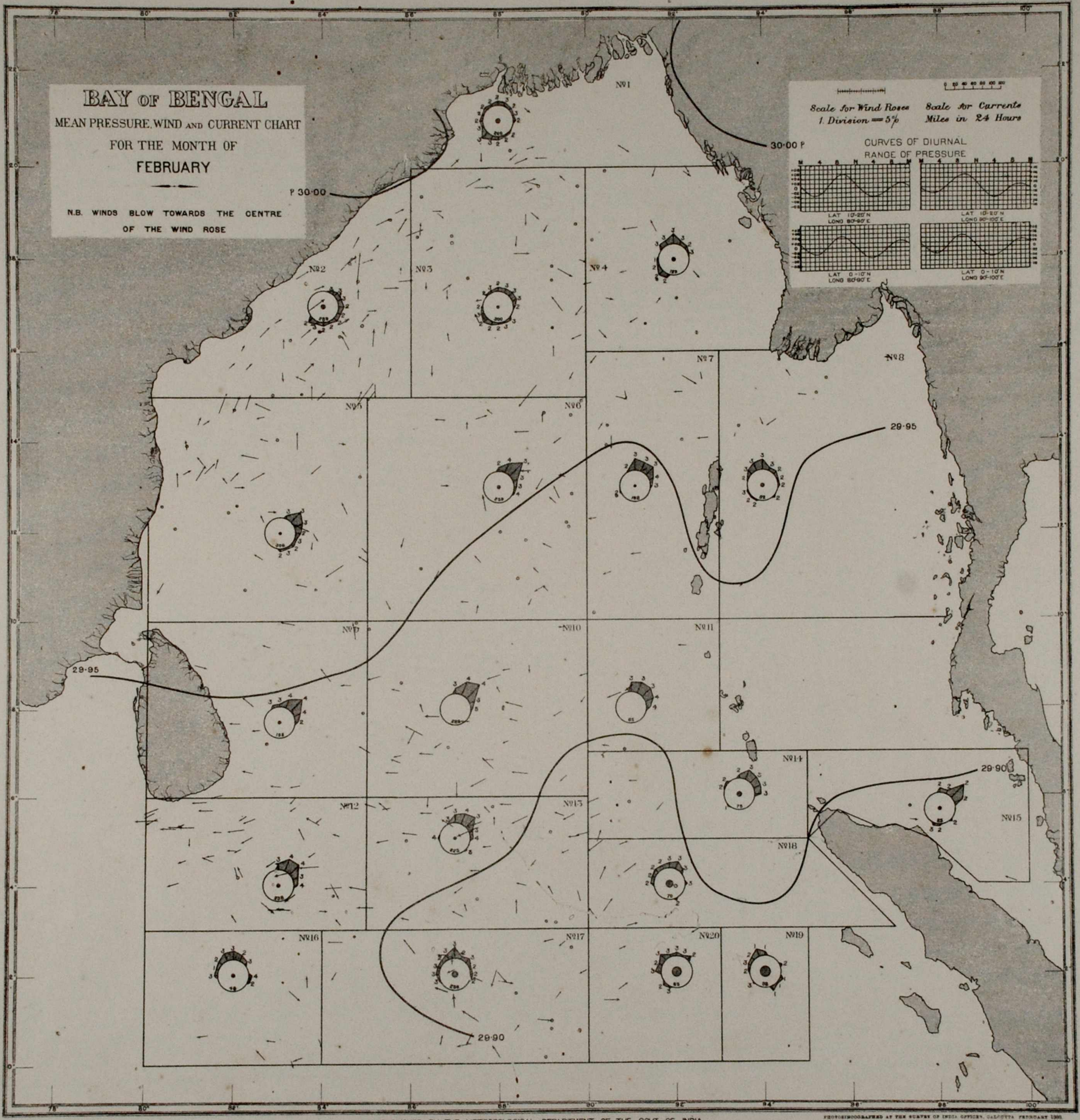
Currents.—The ocean currents shown by the February chart are somewhat better defined than those of January, but in general are still irregular. As in January, a general westerly current prevails in the S.W. of the Bay and in the sea to the south of Ceylon, and sets with some force round the south of that Island. A northerly and north-easterly current has also been developed along the West coast of the Bay. This current commencing in about the Lat. of Madras apparently runs up the West coast nearly as far north as Lat. 20°, where it re-curves and returns towards the centre of the Bay in an irregular southerly set. Between 88° and 92° Long. in the extreme south there are indications of a north-east current probably due to the incipient south-westerly winds.

Number of wind-rose.	Percentages.																
	N.	NNE.	NE.	ENE.	E.	ESE.	SE.	SSE.	S.	SSW.	SW.	WSW.	W.	WNW.	NW.	NNW.	Calms, &c.
1	8·4 1·6	7·3 2·5	5·0 2·3	3·0 2·8	5·2 2·2	1·2 2·5	3·6 2·0	2·9 1·9	7·0 2·2	8·6 2·5	17·1 2·7	2·9 2·8	6·3 1·7	2·5 2·2	6·1 1·8	3·5 2·1	8·9
2	1·6 1·7	2·5 2·5	10·1 2·9	9·2 2·5	11·8 2·4	7·0 1·9	10·2 2·2	4·4 2·3	7·8 2·2	6·3 2·5	13·3 2·1	1·0 2·0	1·5 1·9	1·1 2·5	1·8 1·6	1·2 1·8	9·2
3	8·5 2·4	8·8 2·8	10·1 2·8	10·0 3·0	3·3 2·0	2·1 3·1	5·5 2·6	3·6 2·6	4·1 1·6	8·4 2·2	11·5 2·4	6·1 2·8	3·4 2·0	1·3 2·6	2·5 1·8	4·8 2·5	6·0
4	20·8 2·5	8·6 2·7	7·1 2·1	2·6 3·0	0·2 2·0	0·1 1·0	1·3 1·3	1·3 1·3	2·2 2·3	8·9 2·2	11·5 2·1	4·5 1·8	3·3 1·3	1·2 1·3	9·7 2·9	10·3 3·2	6·4
5	1·0 2·0	9·0 3·2	28·1 2·9	20·0 2·9	11·6 2·2	4·9 2·6	8·2 2·2	3·8 2·6	5·9 2·2	1·0 2·1	1·1 2·1	... ...	0·2 1·0	... ...	0·3 1·5	0·1 3·0	4·8
6	8·5 2·3	21·1 3·5	38·9 3·3	10·8 2·9	5·0 3·1	3·1 3·5	1·6 1·8	0·5 2·7	0·9 1·0	0·3 1·7	0·1 1·0	... ...	0·2 1·5	0·2 2·0	2·3 1·9	0·5 2·0	6·0
7	24·3 2·8	19·5 3·4	22·5 3·2	10·0 3·6	4·4 2·9	0·1 3·0	... ...	0·2 1·0	0·3 2·0	0·5 1·8	1·3 1·5	2·6 1·8	2·2 1·5	1·3 1·5	2·0 2·1	4·2 2·3	4·6
8	20·9 3·0	6·1 2·7	8·8 2·4	2·7 1·5	4·2 1·6	1·5 2·7	3·8 2·1	2·4 2·2	1·2 1·0	2·8 2·2	2·9 2·0	2·7 2·7	1·8 2·5	2·6 1·7	11·3 3·0	16·7 3·4	7·6
9	5·0 2·6	18·5 3·7	33·8 3·5	15·2 4·0	5·5 2·3	2·2 2·6	1·7 1·5	0·2 3·0	0·8 1·7	0·1 3·0	1·4 1·5	1·5 2·3	2·2 1·8	1·1 2·0	1·2 2·3	5·0 2·9	4·6
10	11·1 2·7	27·6 3·8	39·4 3·9	10·5 3·4	4·3 4·6	2·0 3·7	0·6 2·5	0·6 2·5	.. ...	... ..	0·2 2·0	... ...	0·9 3·0	0·2 1·0	0·9 3·3	1·6 2·3	0·1
11	19·9 2·6	23·6 3·3	23·5 3·3	17·8 3·6	7·7 4·4	1·5 2·0	... ...	... ...	0·5 3·0	... ...	1·6 3·0	... ...	... ...	1·6 1·0	... ...	2·3 2·0	...
12	13·9 2·9	24·6 3·9	25·5 3·8	11·3 3·3	7·6 3·5	2·2 2·1	0·9 2·0	0·9 1·8	0·4 2·3	... ...	0·6 2·0	1·3 2·1	1·1 1·9	0·6 2·0	2·1 1·6	1·2 2·1	5·8
13	16·1 2·9	21·5 3·7	27·1 3·4	7·7 3·3	5·5 3·8	1·8 2·5	3·0 2·6	1·7 1·8	0·8 2·4	0·6 1·0	0·1 2·0	1·0 3·0	2·5 3·8	0·9 4·0	1·9 1·8	2·5 2·5	5·3
14	7·3 2·4	20·4 3·1	17·3 3·4	14·6 2·9	13·3 3·0	2·3 2·7	... ...	0·7 2·0	0·3 2·0	1·1 2·0	3·2 1·0	... ...	0·4 3·0	3·4 2·2	4·5 1·7	2·1 1·9	9·1
15	10·0 1·8	8·0 1·5	36·7 2·3	19·3 2·0	2·0 2·0	... ...	4·0 2·0	... ...	4·0 2·0	6·0 2·5	2·0 6·0	... ...	... ...	... ...	... ...	... ...	8·0
16	17·7 3·1	12·6 2·2	7·5 3·0	1·7 3·0	5·5 4·0	4·5 2·3	2·1 3·0	... ...	... ...	... ...	0·5 1·0	2·1 5·0	7·1 3·0	4·9 1·3	9·8 1·9	16·6 2·9	7·4
17	23·1 2·5	6·3 2·4	10·6 2·6	4·4 2·3	4·7 2·0	3·2 2·4	1·9 3·1	0·9 2·9	1·2 1·6	0·3 1·0	0·8 1·5	2·6 3·3	6·3 2·9	5·5 3·1	6·7 2·1	11·9 3·0	9·6
18	11·3 2·5	16·0 3·4	8·7 3·0	0·8 1·5	5·1 2·6	1·1 1·0	0·4 2·0	5·4 2·0	2·1 1·0	0·2 2·0	2·3 1·0	0·5 2·0	6·8 1·8	6·7 1·7	10·1 2·0	8·5 2·3	14·0
19	8·8 1·3	... ...	1·4 1·0	5·6 2·0	0·9 1·0	8·3 1·0	3·7 1·0	11·1 1·0	0·9 1·0	1·9 1·0	2·8 3·0	... ...	2·8 2·0	5·6 3·0	8·3 1·5	15·7 1·0	22·2
20	6·8 2·5	3·2 2·5	11·2 1·8	1·9 2·5	1·0 3·0	0·8 2·0	... ...	1·9 2·0	1·4 1·0	3·8 2·5	6·2 2·3	1·0 2·5	13·1 2·5	8·0 2·3	15·9 3·1	5·1 3·2	18·7

BAY OF BENGAL

MEAN PRESSURE, WIND AND CURRENT CHART
FOR THE MONTH OF
FEBRUARY

N.B. WINDS BLOW TOWARDS THE CENTRE OF THE WIND ROSE



Compiled by W. L. Dallas.

PUBLISHED BY THE METEOROLOGICAL DEPARTMENT OF THE GOVT. OF INDIA.

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METEOROLOGY OF THE BAY OF BENGAL.

MARCH.

Barometric pressure.—The total number of barometric observations employed is 4,364 or 1,300 less than for February, and 1,200 less than for January. As in the previous month there is a disproportionate excess for the western half of the Bay. The March chart, compared with that of the preceding month, shows that there has been a fall of nearly one-tenth of an inch in the average pressure over the head of the Bay, and of one-twentieth of an inch in the south. The effect of this difference has been to neutralize the barometric gradient from north to south, which was the characteristic feature of the two preceding months, and to render the pressure nearly uniform all over the Bay. A slight excess of pressure does, however, exist over the centre of the Bay, a broad band within which readings average about 29·925 inches stretching from the Arrakan Coast across to the Coromandel Coast. On either side of this band, there is a very gradual decrease both northwards and southwards, so that, over the greater part of the region lying to the south of Lat. 10° and to the north of Lat. 20°, the barometer reads slightly below 29·90 inches.

This change marks the transition from the normal cold weather conditions towards those which prevail in the hot weather and rains. Its effect on the direction and force of the winds is very marked.

Winds.—The band of high pressure just noticed is an axis to the wind circulation of the Bay. It runs from the Arrakan Coast in about Lat. 17° to the S. W., crosses the meridian of 90° in Lat. 13° and then passes westward to the Coromandel Coast in about Lat. 12°. To the north of it winds from some southerly quarter generally preponderate as shown by wind-roses Nos. 1, 2, 3, 4 and 5. To the south of the axis the wind-roses in nearly every case have the point of maximum frequency between N. W. and N. E. with a decided preponderance of the latter between Lat. 5° and Lat. 13°. Between Lat. 5° and the equator there is no single preponderating direction, but winds are about equally frequent from easterly, northerly, and westerly quarters; those from between S. E. and S. W. being almost absent. Classifying the wind-roses in the manner adopted in the previous month, it appears that 4 have the point of maximum frequency at N.; 6 at N. E.; 2 at E. N. E.; 1 at S.; 2 at S. S. W.; 2 at S. W.; and 2 at N. N. W., and summing up the data of all the wind-roses for the whole Bay, we have—

	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calms, &c.
February	22	30	11	5	4	6	5	9	8
March	15	19	12	8	10	11	8	9	8

These figures show a further decrease in the winds from north-east and also from north; on the other hand there is a great increase in those from S. and S. W.; calms are about equally frequent.

Force.—The general force of the wind over the whole Bay during March is fractionally less than during February. The average force of the winds from north-east is rather greater than from any other direction, but with this exception, there is great uniformity over the whole surface of the Bay. Over that region of the Bay represented by wind-rose No. 5, the average force is rather less, and in those represented by Nos. 2, 6, 13 and 16 rather greater than elsewhere. The following table showing the mean force of the wind irrespective of direction for each 4° square plainly exhibits this uniformity of force :—

	80–84	84–88	88–92	92–96	96–100
		3·2	2·5	3·7	
20–16	2·5	2·8	2·3	2·2	1·9
16–12	2·2	2·4	2·2	2·1	2·3
12–8	2·6	2·6	2·5	2·4	1·6
8–4	2·4	2·6	2·5	2·7	2·1
4–0	2·6	2·5	2·2	2·2	—

Gales.—Gales have been more frequent in March than in February and about as frequent as in January. They have been almost entirely confined to the western half of the Bay. Within the present series of observations gales are recorded in the years 1858 and 1862. In the former year the evidence is insufficient to show the character of the disturbance causing them, but in 1862 a distinct cyclonic vortex seems to have been formed in the extreme south, whence it travelled northward as far as Lat. 15°.

The following is the List of all the recorded cases of gales during March :—

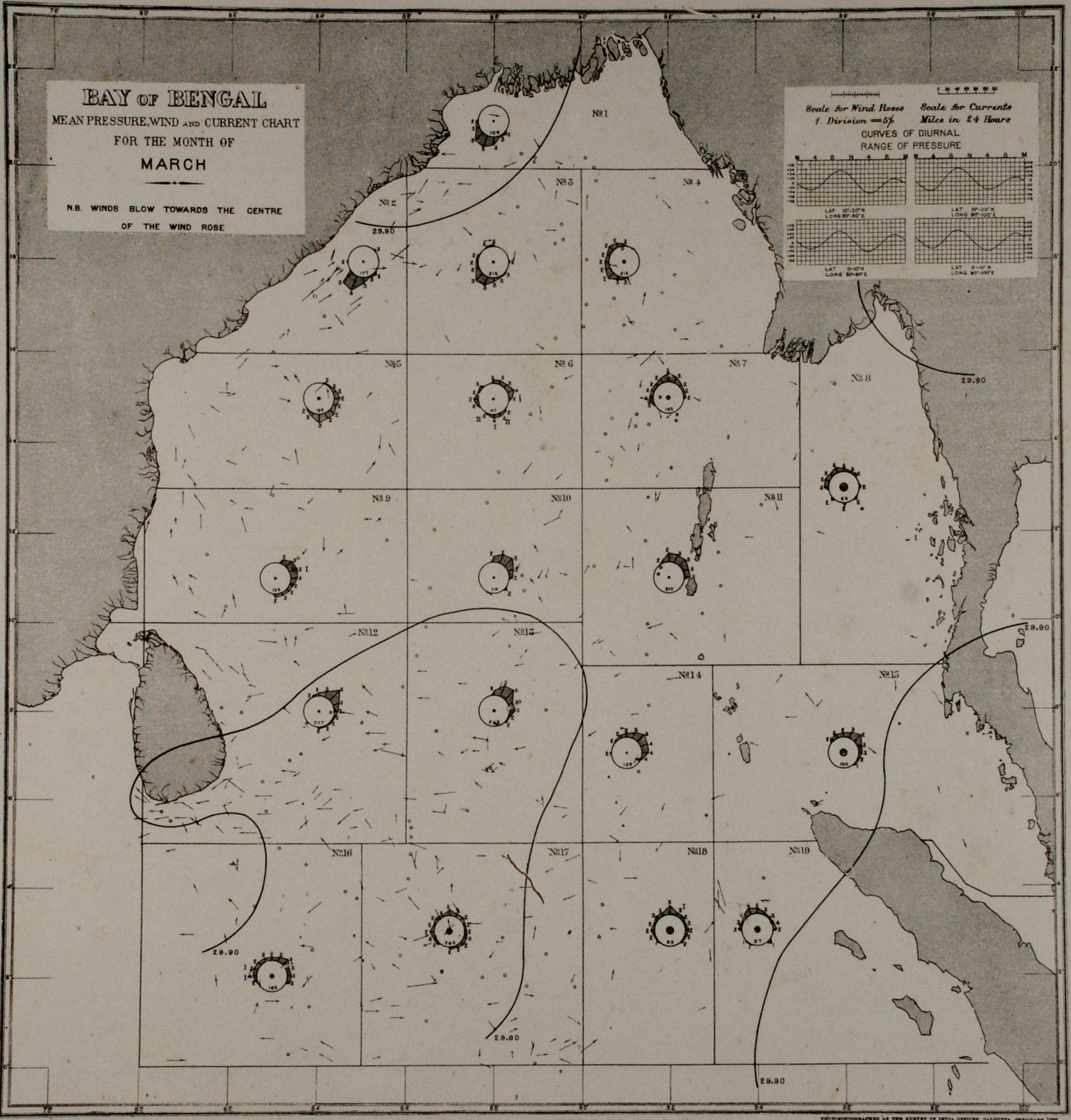
1820—March 29—30.—Gale at Madras.
1853— „ 26—28.—Furious hurricane on Coromandel Coast, south of Madras.
1858— „ ? Gale in south of Bay.
1862— „ 14—24.—Cyclone formed in extreme south of Bay in Longitude 88° and travelled slowly northward to Latitude 15°. Blew a hurricane Latitude 14°, Longitude 87°.

In the case of the gale in 1862 it is estimated that 15 inches of rain fell within the 8 hours preceding 2-30 P.M. on the 24th.

A ship the "Captain Cook" at 9 P.M. on the 24th in Lat. 14° 39′ and Long. 86° 50′ lost all top gallant gear in a hurricane from all quarters.

Currents.—The most important changes in the ocean currents of the present month are, the falling off in the strength and extent of the westerly current in the S.W. corner of the Bay and round the south of Ceylon and the extension southward of the northerly current, noticed in the previous month, along the western side of the Bay. This set now originates as a north-westerly current off the north-east coast of Ceylon, runs in this direction up the coast of the Peninsula as far as Negapatam where it becomes northerly and continues as far as the mouth of the Kistna, thence changing its direction with that of the Coast, it runs as a north-east current right up to Orissa. In the Central, Southern and Eastern parts of the Bay there are no regular or general currents, and indeed over the Central parts of the Bay to the northward of Lat. 10° a large number of observations show that there is no movement.

No. of Wind-Rose.	Percentages.																
	N.	NNE.	NE.	ENE.	E.	ESE.	SE.	SSE.	S.	SSW.	SW.	WSW.	W.	WNW.	NW.	NNW.	Calms and light variable airs.
1	0·3 2·0	0·3 3·0	0·7 2·0	0·3 3·0	2·3 2·6	0·4 3·0	6·1 2·8	2·7 2·5	17·0 3·1	24·8 2·7	24·0 3·0	8·0 3·4	5·4 2·0	2·1 1·3	0·8 3·3	0·7 2·8	4·1
2	0·4 2·0	... ...	3·0 3·0	0·6 1·0	1·6 2·5	1·8 2·1	5·5 2·4	2·6 2·7	13·4 2·5	31·6 3·1	28·9 2·9	0·8 3·5	2·5 2·4	0·4 2·0	1·3 5·0	0·7 5·0	4·9
3	4·0 2·9	2·0 2·5	1·7 2·6	1·4 2·3	2·5 2·1	1·2 2·0	2·5 2·8	3·8 2·8	10·4 2·6	20·2 3·1	22·2 2·7	7·9 2·7	5·0 2·0	4·9 2·4	2·1 1·6	2·9 2·4	5·3
4	3·8 2·2	0·6 2·1	1·7 2·8	1·0 1·7	1·3 1·2	1·1 2·0	1·5 1·6	2·1 1·6	4·5 2·7	8·2 2·8	16·6 2·4	10·9 2·4	9·3 2·4	6·8 2·3	13·2 2·2	9·9 2·2	7·5
5	1·1 1·4	2·9 2·0	2·9 2·2	7·1 2·3	11·8 1·8	7·3 1·5	13·5 2·2	14·4 2·4	18·6 2·5	9·4 2·0	2·8 1·7	1·3 1·5	0·6 2·0	... ...	0·1 1·0	0·1 1·0	6·1
6	6·7 1·8	8·9 3·3	9·9 2·7	14·9 3·6	6·4 2·0	... ...	5·2 2·3	6·9 5·0	7·5 4·4	2·7 2·5	... ...	5·0 2·8	10·4 2·1	3·1 2·0	5·7 2·6	1·6 1·7	5·1
7	18·5 1·9	13·3 2·0	7·1 2·2	4·1 1·9	4·8 2·1	1·3 2·1	1·5 3·3	0·1 2·0	0·4 2·2	1·6 2·1	2·1 2·1	4·4 2·0	7·7 2·0	6·8 1·9	7·0 1·9	10·6 2·2	8·7
8	6·4 2·4	2·8 1·5	5·3 1·8	1·5 1·7	3·7 2·4	0·3 1·0	4·8 1·8	0·8 1·5	7·3 2·4	2·2 2·3	6·5 2·0	1·7 2·8	10·2 2·5	10·5 2·6	7·9 2·1	10·9 2·3	17·2
9	0·3 1·0	10·4 2·9	16·5 2·7	18·4 3·1	15·4 2·3	9·0 1·9	8·1 2·1	6·5 2·4	7·8 2·0	0·3 1·0	0·6 1·5	0·6 2·0	... ...	... ...	... ...	0·7 1·5	5·4
10	13·0 2·2	19·0 2·4	23·6 3·0	12·9 3·2	8·4 2·0	2·0 2·0	6·9 1·9	1·9 1·9	0·7 2·3	2·1 4·0	0·1 1·0	1·9 2·3	1·9 1·3	0·3 1·0	0·3 1·0	0·1 3·0	4·9
11	19·4 2·3	18·3 2·6	17·5 2·7	11·8 3·1	12·7 2·5	2·2 2·8	1·0 2·8	... ...	0·5 3·0	0·3 1·5	... ...	[illegible] 1·0	2·1 2·0	2·2 2·4	2·4 2·2	4·6 2·1	4·9
12	6·4 1·9	11·6 3·1	29·1 3·0	13·4 2·9	8·3 2·8	3·2 2·3	3·0 1·5	2·6 2·1	3·9 1·9	2·4 2·2	2·7 [illegible]	1·6 1·9	1·7 2·3	0·9 1·8	1·3 1·4	2·7 2·0	5·2
13	9·6 2·3	23·7 2·8	25·0 2·9	10·0 3·1	11·7 2·6	2·7 2·3	3·5 1·7	0·7 2·2	0·1 1·0	0·3 2·3	0·8 1·8	0·9 4·8	1·3 5·4	0·9 4·5	0·8 2·9	1·7 2·0	6·3
14	8·2 2·6	12·7 3·1	20·4 3·1	15·3 3·9	13·0 4·0	4·2 3·6	1·0 2·0	2·3 3·3	1·8 2·5	0·8 1·7	0·2 1·0	2·1 1·5	3·2 1·8	1·3 2·8	3·2 2·4	6·0 2·3	4·3
15	9·0 2·0	13·2 2·8	19·8 2·3	8·9 2·6	6·5 2·5	2·6 2·2	3·9 1·3	... ...	0·7 2·0	0·8 2·0	... ...	0·9 1·3	1·1 1·0	0·8 1·5	6·8 2·4	7·9 2·5	17·1
16	4·6 1·8	8·6 2·2	14·9 2·7	6·2 2·7	8·0 [illegible]	6·9 2·0	2·0 0·6	0·9 2·4	2·4 3·2	1·9 3·2	1·1 3·8	2·8 2·4	7·5 3·7	9·3 3·2	8·0 2·3	6·4 2·2	8·5
17	11·8 2·1	5·9 2·4	8·0 2·4	2·5 2·3	4·2 2·4	5·5 2·5	6·7 2·1	3·0 2·2	3·8 2·4	1·8 2·3	4·9 2·6	5·1 2·5	9·5 2·4	3·9 2·4	8·0 2·3	4·1 2·8	11·3
18	17·9 2·5	6·8 2·7	6·7 2·4	3·1 3·0	8·0 2·2	3·6 1·8	4·7 1·9	0·5 2·0	2·0 1·7	0·7 1·5	3·3 1·4	2·5 2·1	7·5 1·5	4·1 2·4	8·3 3·2	5·8 2·5	14·5
19	10·8 1·8	6·1 1·7	3·4 2·5	4·6 3·5	8·9 2·3	0·6 2·0	9·9 1·3	... ...	1·3 1·0	2·5 1·0	3·0 1·0	... ...	8·6 2·0	3·7 2·8	9·3 3·7	14·9 3·5	12·4



BAY OF BENGAL
MEAN PRESSURE, WIND AND CURRENT CHART FOR THE MONTH OF MARCH

N.B. WINDS BLOW TOWARDS THE CENTRE OF THE WIND ROSE

Compiled by W. L. Dallas.

PUBLISHED BY THE METEOROLOGICAL DEPARTMENT OF THE GOVT. OF INDIA.

PHOTOZINCOGRAPHED AT THE SURVEY OF INDIA OFFICES, CALCUTTA, FEBRUARY 1886

METEOROLOGY OF THE BAY OF BENGAL.

APRIL.

Barometric pressure.—The April chart shows the distribution of pressure that characterises the hot weather. The relatively high pressure over the centre of the Bay has disappeared, and there is an area of low readings only over the head of the Bay, whence the pressure increases gradually to the south and south-east, reaching a maximum in the neighbourhood of Sumatra. The fall of pressure between March and April amounts to about 0·1 inch in the north, to 0·05 inch in the centre and S. W. and to only a few hundredths in the south-east of the Bay. The barometric difference between the north and south is as yet slight, the mean pressure in the extreme north being about 29·794 inches, and in the extreme south about 29·894 inches, a difference of 0·1 inch for 20° of latitude.

Winds.—In the southern portion of the chart, the region illustrated by the wind-roses Nos. 8 to 18, the percentage of calms is high, and with one or two exceptions the wind-roses show no marked preponderance of winds from any one direction. Nos. 14 and 16 are partial exceptions, the west components being dominant. In some of the wind-roses, notably Nos. 8 and 17, the calms are nearly twice as frequent as any single wind direction.

Over the head of the Bay this neutrality disappears. The wind-roses 1 to 7 exhibit strongly-marked maxima, the effect of the highly-heated land in their neighbourhood. In the west of the Bay (Nos. 4 and 7) this maximum is at south and south-east; over the head of the Bay (Nos. 1, 2, and 5) at S. S. W. and S. W.; and in the east (Nos. 3 and 6) at W. and N. W.

Summing up the figures for the whole Bay, the percentages are as follow, March being added for comparison:—

	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calms, &c.
March	15	19	12	8	10	11	8	9	8
April	5	8	9	11	16	19	14	8	10

These figures show a change similar in character to that noticed in March, but greater in amount. There is a further decrease in the winds from N. and N. E., and an increase in those from S., S. W. and W. The greatest decrease (11 per cent.) is at N. E. the greatest increase (8 per cent.) at S. W. Calms have also increased, and the total is in excess of the total of any other month though closely approached by October.

Force.—Notwithstanding the frequency of calms, the mean force of the wind is greater than in the preceding month. It is still slightly greater when the wind is north-easterly (N. E. and E. N. E.) than when it blows from any other quarter, but S. S. E., W. S. W., and N. N. W. winds are nearly as strong. Wind-roses Nos. 3 and 18 have the lowest average force, and Nos. 1, 5, and 7 the highest. The high average force of No. 7 is due to strong winds from between N. and W.

The following diagram gives the mean force of the wind irrespective of direction for each 4° square :—

	80		84		88		92		96		100	
				3·5		3·6		2·7				
20												20
		2·5		3·3		2·5		2·0		3·0		
16												16
		3·2		3·0		2·5		2·4		2·4		
12												12
		2·7		2·7		2·5		2·0		2·2		
8												8
		2·6		2·6		2·4		2·5		2·0		
4												4
		2·9		2·7		2·2		2·8		4·0		
0												0
	80		84		88		92		96		100	

Gales.—Most of the reported gales were experienced in the central portion of the area. The more important occurred in the years 1859, 1860, and 1875; but winds of force, 8 or above, were experienced also in 1856, 1858, 1863, 1866, 1872, and 1873.

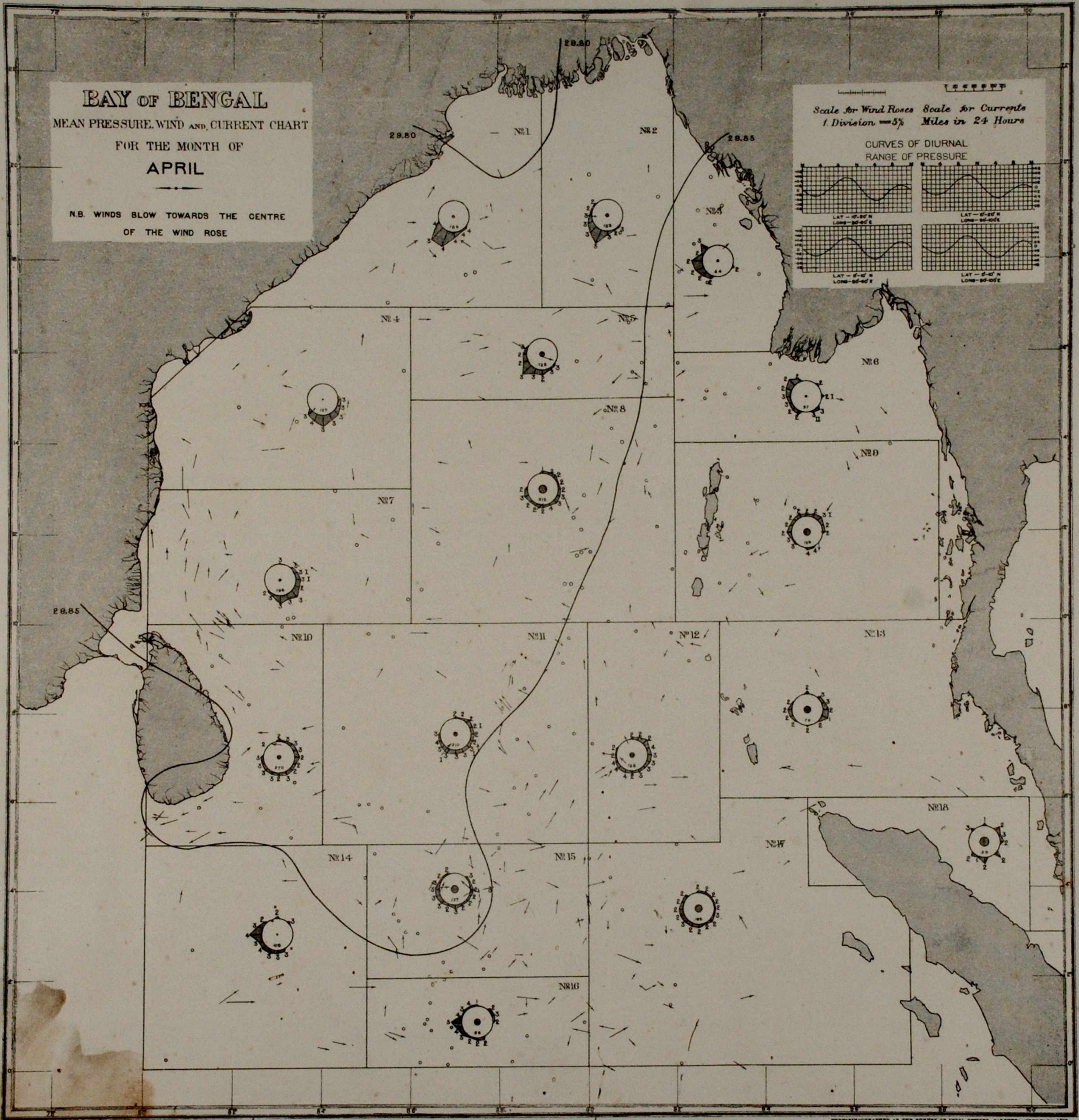
The following is the list of recorded gales in April:—

1749,	April	13th.—A furious hurricane on the Coromandel Coast.
1840	„	27th to May 1st.—A cyclone crossed from the Andamans to the Orissa Coast; the centre passing just south of Pooree. The effects were felt at Calcutta.
1848	„	23rd.—Violent hurricane off Ceylon.
1850	„	23rd to 28th.—A cyclone was formed to the west of the Nicobars, and passed northward to Bengal, passing between Midnapore and Calcutta.
1854	„	21st to 23rd.—Violent hurricane in Gulf of Martaban.
1858	April	9th and 10th.—Cyclone passed from Andamans to Cape Negrais. Centre passed between Henzada and Rangoon.
185	„	921st to 27th.—Gale over Bay of Bengal and Andaman Sea. Greatest violence in neighbourhood of Negapatam.
1860	„	6th to 11th.—Cyclone formed over centre of Bay to westward of Nicobars; travelled northward to latitude 15°.
1875	„	22nd.—Cyclone off Coromandel Coast.

Currents.—The ocean currents of April are similar in many respects to those of March. There has, however, been a further and considerable falling off in the strength of the westerly current round the south of Ceylon. This current is now confined to those portions of the sea immediately contiguous to the Ceylon Coast, for further to the southward, that is, between the equator and Latitude 2°, an easterly current is appearing. Between longitude 86° and longitude 90° in the southern part of our area, there is an exceedingly confused current. Within the Bay proper there seems to be a fairly regular circulation of the water. On the western side of the Bay a northerly set runs parallel to the Coast from Ceylon as far as Latitude 16° to 18° where it turns eastward across the head of the Bay and returns down the eastern side as a southerly current. In the centre of the Bay there are, as in March, a great many observations showing no current.

The following are the figures on which the wind-roses are founded :—

No. of Wind-Rose.	Percentages.																
	N.	NNE.	NE.	ENE.	E.	ESE.	SE.	SSE.	S.	SSW.	SW.	WSW.	W.	WNW.	NW.	NNW.	Calms.
1	1·0 4·0	... ...	0·1 3·0	0·3 5·0	0·3 2·0	0·6 1·5	4·2 3·7	3·4 4·2	13·5 3·6	33·8 3·6	33·7 3·4	4·3 3·8	1·1 3·2	0·4 2·7	... ...	0·6 1·5	2·7
2	0·9 2·0	0·8 2·0	0·6 3·0	... ...	2·1 2·8	0·2 3·0	2·6 2·9	2·5 2·2	8·1 2·5	30·2 3·1	18·9 2·5	12·4 2·5	5·0 2·9	1·9 1·7	3·2 1·9	3·3 4·3	7·3
3	0·3 1·0	... ...	... ...	... ...	... ...	4·3 2·0	0·9 1·5	0·9 1·0	2·3 1·3	7·5 1·5	11·7 2·0	18·5 2·2	23·3 2·4	4·0 1·6	18·7 2·8	2·2 3·0	5·4
4	... ...	... ...	1·1 1·5	0·8 3·0	5·2 2·6	6·2 2·6	12·7 2·7	14·0 2·8	24·1 3·1	16·1 3·5	13·1 2·7	0·8 2·0	2·0 2·8	... ...	0·9 2·0	... ...	3·0
5	1·9 5·1	1·0 1·2	1·9 3·4	1·3 4·5	1·6 3·9	1·1 3·8	3·7 2·7	3·3 2·6	11·2 2·2	11·7 2·5	25·0 2·8	10·4 2·0	8·4 1·8	4·3 2·5	1·4 2·2	0·2 7·0	11·6
6	1·5 2·5	1·4 1·3	4·1 2·0	0·5 7·0	4·9 2·4	0·8 1·5	6·9 3·3	3·0 5·2	2·4 1·6	8·6 2·3	8·0 2·0	5·1 2·8	9·9 2·5	13·4 2·0	17·4 1·9	6·2 2·4	5·9
7	2·5 2·8	1·0 3·6	4·0 4·6	6·1 3·4	10·8 2·9	10·9 1·9	18·2 2·5	11·6 2·6	16·8 2·9	5·1 2·8	3·0 1·7	0·7 3·0	1·1 3·3	0·4 5·9	1·9 4·8	1·6 4·5	4·3
8	5·4 1·4	4·4 2·3	7·1 2·1	2·9 2·2	5·3 2·0	6·5 2·8	9·2 2·9	4·5 3·5	6·6 2·3	5·2 2·1	4·9 2·4	9·2 2·8	5·7 2·2	1·8 2·3	2·2 1·7	0·9 3·3	18·2
9	4·7 1·8	8·7 1·7	10·8 2·5	5·4 2·4	5·1 1·9	0·7 2·3	0·6 3·5	3·0 3·6	4·9 3·6	1·8 3·5	3·7 3·0	3·0 2·8	10·5 1·7	6·5 2·1	7·7 2·0	8·5 1·6	14·4
10	5·0 1·6	3·2 3·2	7·6 2·5	7·4 2·7	10·7 2·4	5·8 2·3	6·7 2·2	7·7 2·5	5·6 2·3	6·8 2·8	7·8 2·5	5·2 2·8	6·3 3·2	2·3 2·4	2·8 2·3	0·9 2·2	8·2
11	3·2 1·8	2·5 2·3	8·8 2·2	5·9 2·4	8·1 2·3	6·1 2·2	8·1 2·5	8·8 2·7	8·0 2·7	10·0 3·2	7·8 2·9	4·8 3·6	3·0 3·0	1·3 1·8	2·0 1·5	1·9 1·8	9·7
12	2·9 1·8	7·1 1·9	11·8 1·8	5·9 3·5	9·2 3·1	7·8 2·5	5·3 3·4	5·0 3·1	4·6 2·2	7·5 3·9	8·4 4·2	4·4 3·5	2·5 2·4	2·6 1·7	2·3 2·6	2·2 1·9	10·5
13	6·6 1·6	2·4 2·0	5·8 2·8	7·3 2·6	11·9 2·4	14·3 1·4	4·0 1·8	0·7 2·0	3·3 1·7	2·0 2·7	3·6 2·0	7·5 2·4	9·6 2·4	2·7 2·3	1·8 2·0	1·7 2·0	14·8
14	4·4 2·2	2·2 1·0	3·5 2·6	1·5 2·3	0·2 3·0	0·2 3·0	0·6 1·5	5·7 2·5	6·3 2·5	9·1 2·8	9·9 3·8	8·9 3·0	25·6 3·6	11·4 2·5	4·1 2·3	1·9 1·6	4·5
15	2·3 1·5	1·0 1·8	4·3 2·6	2·9 2·3	6·2 2·1	4·7 2·4	4·6 2·4	4·0 2·2	8·6 2·8	4·7 2·4	9·1 3·0	10·1 3·0	10·3 3·0	4·6 2·9	4·7 2·4	3·9 1·8	14·0
16	3·5 1·3	0·8 2·0	5·5 1·6	5·4 2·6	3·5 2·1	1·4 1·5	... ...	6·5 2·4	5·4 2·1	3·0 2·2	7·9 2·5	10·2 4·3	22·9 4·5	3·1 3·6	3·9 3·3	3·6 3·9	13·4
17	4·2 1·7	4·2 1·7	3·4 1·8	2·6 1·8	3·0 1·9	3·2 2·5	6·4 1·9	21·8 2·1	7·0 2·1	7·2 2·2	8·4 2·8	9·0 2·4	9·0 2·4	5·0 2·3	7·1 2·2	0·9 3·0	16·6
18	5·1 1·0	1·5 2·5	11·6 2·0	3·8 2·5	7·7 2·0	... ...	14·7 2·1	... ...	13·5 2·4	2·5 1·0	8·8 1·7	1·2 1·0	1·3 1·5	1·5 2·5	6·0 2·5	1·5 2·0	19·3



BAY OF BENGAL

MEAN PRESSURE, WIND AND CURRENT CHART

FOR THE MONTH OF

APRIL

N.B. WINDS BLOW TOWARDS THE CENTRE OF THE WIND ROSE

Scale for Wind Roses
1. Division = 5%

Scale for Currents
Miles in 24 Hours

CURVES OF DIURNAL RANGE OF PRESSURE

Compiled by W. L. Dallas.

PUBLISHED BY THE METEOROLOGICAL DEPARTMENT OF THE GOVT. OF INDIA.

PHOTOZINCOGRAPHED AT THE SURVEY OF INDIA OFFICES, CALCUTTA, FEBRUARY 1886

METEOROLOGY OF THE BAY OF BENGAL.

MAY.

Barometric Pressure.—The May chart shows a distribution of pressure very similar to that of April, but with a somewhat greater difference between the north and south of the Bay. Barometric readings range from 29·69 ins. in the N. W. corner to 29·85 ins. in the S. E. corner, an increase of 0·06 in. on the range of the preceding month. This increase is principally due to the fall of the barometer over the north-western portion of the Bay in sympathy with that which at this season takes place in the Central Provinces, Ganjam, and Orissa. In April the mean pressure off the Orissa coast was 29·79 ins., and in May only 29·69 ins., while in the neighbourhood of the Equator there has been a fall of only 0·04 in.

The chart shows that the isobar 29·85 ins. runs in a north-easterly direction from Long. 84° and strikes the coast of the Malay Peninsula in about Lat. 13°. A parallel course is followed by all the isobars and is attributable to their forming part of a pressure system having its centre of lowest readings in Orissa and Chutia-Nagpur. In the east of the Bay, a ridge of slightly higher pressure (indicated by the isobars 29·80 ins. and 29·85 ins.) runs from the Nicobars to Cape Negrais. This ridge is accompanied by an increase in winds from W. and W. N. W. (wind-roses 5 and 17).

Winds.—As compared with April a considerable change has occurred in the winds of the Bay. Instead of variable winds and calms, south-westerly winds predominate all over the Bay, and the Equatorial sea to the southward. Except perhaps in wind-rose No. 17 the maximum prevalence is between the points of S. S. W. and W. S. W., and in nearly all cases strongly marked. In wind-rose No. 1,79 per cent. of all the winds are from between S. and W. S. W. Calms are much less frequent than during April and, except in the neighbourhood of Sumatra and in the Andaman Sea, form only a small percentage of the observations. The following figures give the mean percentages for the whole Bay with the values for April added for comparison :—

	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calms, &c.
April	5	8	9	11	16	19	14	8	10
May	2	2	3	5	20	41	17	4	6

The rapid increase in S. W. winds is here very remarkable.

Force.—The mean force of the wind for the whole Bay has risen from 2·5 in April to 2·9 in the present month. The greatest mean strength, *viz.*, 3·6, is now at S. W.; nevertheless in the case of no less than 9 wind-roses the strongest wind registered was from some northerly direction. This is particularly the case in the neighbourhood of land; a peculiarity probably due to small squalls off the land which are so common at this season.

The following table gives the average force of the wind for each four-degree square. It shows that in the vertical strip between Long. 84° and 88° and in the transverse strip between Lat. 12° and 16° is found the greatest average force at this season.

	80 – 84	84 – 88	88 – 92	92 – 96	96 – 100
20 –		3·3	3·1	—	
16 – 20	2·7	3·8	3·1	2·3	1·5
12 – 16	3·4	3·7	3·1	2·9	4·0
8 – 12	3·1	4·0	3·4	3·0	3·4
4 – 8	3·2	3·4	3·1	2·8	2·3
0 – 4	3·4	3·1	2·4	2·2	1·0

Gales.—During May the weather over the Bay is liable to most violent disturbance. Though many years often pass without their appearance, experience has proved that with the single exception of October extensive cyclonic storms are more likely to occur during this month than at any other season of the year.

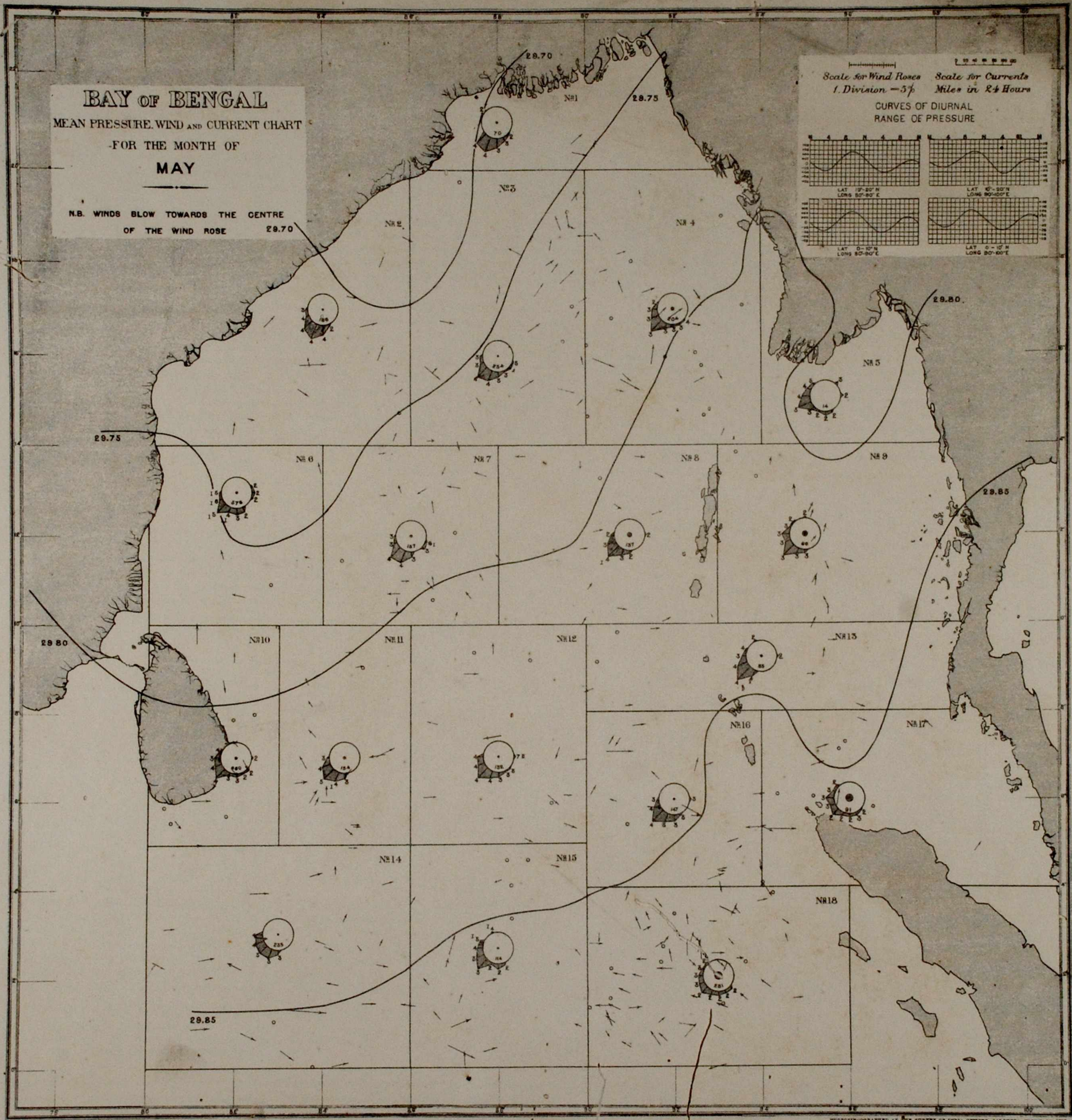
The following is a list of recorded gales :—

1787 May 19-20 Great storm at Coringa.
1811 „ 3 „ at Madras, destroyed nearly every vessel in the roads.
1820 „ 8 Gale at Madras; crossed Peninsula to Malabar Coast.
1823 „ 26 Gale passed from north of Bay over Balasore.
1827 „ 7—10 Gale at Madras.
1830 „ 26 Cyclone passed northward up the Bay; fresh gale Calcutta.
1832 „ 21 Storm in Gangetic Delta.
1833 „ 21 Storm at mouth of Hugli; storm local.
1840 „ ? Hurricane off Madras and Southern Coast.
1841 „ 16 Cyclone passed from S. W. of the Andamans to Madras; the centre apparently passed over Madras.
1842 „ 31 to June 5. Great cyclone in Calcutta on 3rd June. The most severe gale ever felt in Calcutta. The centre passed over the city.
1843 May 19—23 Cyclone passed from south of the Bay north-westward to Ongole.
1844 „ 11 Gale at Noakhally and Chittagong.
1849 „ 12—15 Gale at Chittagong.
1851 April 30 to May 6. Cyclone passed from the north-east of Ceylon to Madras; passing to the northward of the town; south-west winds.
1852 May 12—15 Cyclone started in lat. 15° and passed due north to the Sunderbuns; the centre passing 39 miles east of Calcutta.
1855 „ 15—29 Cyclone over centre of Bay.
1858 „ 15—20 Gale over centre of Bay; subsequently passed across to the Malabar Coast.
1869 „ 1 Cyclone in north-east of Bay.
1869 „ 13—17 Cyclone passed from Cape Nigrais; north-westward to Bengal.
1870 „ 28—30 Cyclone in north-east of the Bay.
1872 „ 1—3 Severe cyclone formed in about Lat. 7° 30′ passed north-westward to Madras.
1872 „ 28—31 Slight gale in centre of the Bay.
1874 „ 1—5 Cyclone originated near Lat. 9°; Long. 85°; travelled north-westward towards Madras, but did not reach land.
1876 „ 10—13 Cyclone formed to W. of the 10° channel; travelled slowly northward.
1877 „ 12—22 Cyclone generated in south of Bay; travelled north-westward to mouth of Pennaar.
1879 „ 19—24 Generated in south of Bay to south-west of Andamans; travelled W. N. W. to Coromandel Coast near Madras.
1879 „ 29 to June 2 Formed near head of Bay; travelled to Balasore.
1881 May 26—28 Generated over head of Bay; advanced northward over Sunderbuns.

Currents.—The recorded currents are exceedingly irregular. The westerly current of previous months round the south of Ceylon has entirely, and the *long shore* current up the western side of the Bay, almost disappeared. There is now little or no current immediately to the south of Ceylon, though two observations give a slight easterly set, but further southward in Lat. 0° to 4°, there is a distinct easterly current. This is met in Long. 90° by a westerly set which apparently prevails through about 4 degrees of Longitude. In the western half of the Bay and in the Andaman sea the currents are generally northerly; in the north of the Bay north-easterly, but in Lat. 15° and 16° easterly and south-easterly currents are frequent, and strongest about Long. 90°, and in the east of the Bay, easterly currents prevail to the west of the Andamans and Nicobars. This easterly current is prolonged eastwards past the Nicobars and Achin to the entrance of the Malacca Straits.

The following are the figures on which the wind-roses are founded :—

Number of Wind-rose.	Percentages.																
	N.	NNE.	NE.	ENE.	E.	ESE.	SE.	SSE.	S.	SSW.	SW.	WSW.	W.	WNW.	NW.	NNW.	Calms, &c.
1	... ...	... ...	... ...	... ...	... ..	... ...	3·6 2·0	9·2 3·2	19·0 3·1	31·5 4·0	27·2 3·7	1·4 3·8	1·4 2·5	... ...	2·6 2·0	... ...	4·1
2	0·3 3·0	- ...	0·6 1·0	0·5 1·5	0·2 2·0	1·2 1·5	2·2 2·1	4·1 2·1	20·4 3·5	31·9 4·1	24·2 3·6	5·6 4·0	4·8 2·8	0·9 5·0	0.5 6·0	... ...	2·6
3	0·8 2·3	0·3 4·0	0·9 5·2	0·1 3·0	1·3 5·2	3·9 4·7	5·5 4·0	3·6 2·6	11·4 3·1	23·8 4·1	28·4 3·8	8·3 3·0	5·4 3·0	1·5 3·3	1·6 2·6	0·5 4·0	2·7
4	2·4 2·5	0·3 1·7	2·0 2·3	0·1 3·0	0·1 1·0	... ...	2·9 3·8	3·7 3·4	4·9 2·8	12·0 3·3	31·5 3·4	15·9 3·3	11·5 2·5	2·8 2·2	1·7 2·3	0·6 2·2	7·6
5	... ...	... ...	7·1 3·0	... ...	5·4 2·0	... ...	1·8 2·0	5·3 1·5	8·9 2·0	3·6 2·0	8·9 3·0	29·2 2·7	16·7 4·0	8·3 3·5	4·8 5·0	... ...	...
6	1·6 7·0	... ...	0·5 1·0	3·2 1·5	6·1 1·7	3·7 2·1	2·3 1·6	10·9 2·4	14·4 3·4	11·8 3·8	25·0 4·5	6·9 5·7	4·6 5·2	0·8 2·0	1·5 5·7	1·5 4·5	5·2
7	1·5 5·8	0·2 10·0	0·7 6·3	0·3 5·0	1·7 2·8	3·3 5·8	6·1 3·0	1·3 1·8	12·9 3·0	26·6 3·9	28·7 4·1	6·6 3·4	3·6 2·8	0·1 2·0	0·9 2·3	0·3 3·5	5·2
8	2·0 3·4	1·2 2·5	1·1 3·3	0·9 2·5	3·3 2·4	0·3 1·5	2·4 2·0	0·7 3·3	6·6 2·4	13·3 3·2	30·4 3·8	18·0 2·8	6·8 2·4	... ...	1·1 4·4	2·1 3·5	9·8
9	2·9 2·2	0·5 1·0	... ...	0·4 1·0	... ...	0·3 1·0	... ...	0·5 1·0	6·8 2·6	11·5 3·4	30·2 3·0	11·6 2·6	17·0 2·8	2·9 2·7	3·2 1·8	0·9 2·8	11·3
10	0·6 2·0	... ...	0·9 2·0	1·1 1·9	3·7 2·2	1·7 1·8	5·0 2·0	4·8 1·8	7·8 2·5	6·7 2·9	26·7 3·8	15·1 4·4	13·6 3·4	4·3 3·5	2·2 2·3	0·2 3·0	5·6
11	0·2 1·0	0·3 1·0	2·2 1·7	2·4 1·8	1·8 1·3	0·8 1·1	2·4 1·6	1·2 2·5	11·1 2·9	20·7 4·2	29·1 4·6	18·2 4·0	4·2 3·1	0·2 2·0	0·2 2·0	... ..	5·0
12	0·9 1·3	0·4 5·0	0·2 1·0	... ...	3·2 7·4	1·1 7·5	2·6 3·4	2·6 3·3	10·1 2·9	15·8 3·8	29·0 4·2	14·7 3·7	13·1 4·2	1·3 3·0	0·7 2·0	... ...	4·3
13	1·3 3·0	... ...	0·6 1·0	1·2 2·5	2·9 2·0	0·6 2·0	... ...	0·2 2·0	2·2 1·9	12·1 3·8	37·2 4·2	21·7 3·8	8·1 3·4	2·9 3·6	1·1 1·5	2·9 1·7	5·0
14	0·7 3·3	0·1 1·0	0·3 1·5	2·1 2·3	0·9 1·5	0·2 2·0	2·0 1·7	2·2 1·2	9·7 2·5	20·7 2·9	21·4 3·4	18·8 3·9	14·8 3·8	1·1 5·3	0·8 4·3	... ...	4·2
15	1·3 1·4	1·3 2·7	1·5 3·0	0·2 1·0	0·9 2·5	0·9 2·0	1·5 2·5	4·8 2·0	10·3 2·3	3·2 1·9	27·0 3·3	17·0 3·4	11·5 3·9	9·4 4·5	1·5 3·2	3·1 3·8	4·6
16	1·0 1·7	0·3 1·0	0·6 2·0	2·4 2·6	3·1 2·5	0·1 2·0	0·9 2·3	3·2 2·7	13·6 2·6	18·1 3·2	31·2 3·9	14·5 3·8	3·3 2·6	0·7 6·0	2·1 2·6	0·2 4·0	4·7
17	1·7 1·7	0·5 1·5	2·1 1·5	... ...	1·7 1·0	1·1 1·5	3·2 2·0	6·0 2·5	7·1 2·4	7·0 2·2	16·2 2·1	10·9 3·0	17·4 3·3	4·9 3·0	5·7 2·3	... ...	14·5
18	2·0 2·1	0·5 2·1	0·9 1·5	0·4 2·3	2·2 1·5	0·9 2·0	6·4 1·6	5·9 1·6	8·8 1·9	10·1 2·2	16·8 2·4	11·6 2·8	9·6 3·3	3·8 3·0	3·4 2·0	1·5 1·9	15·2



BAY OF BENGAL

MEAN PRESSURE, WIND AND CURRENT CHART
FOR THE MONTH OF

MAY

N.B. WINDS BLOW TOWARDS THE CENTRE
OF THE WIND ROSE

Scale for Wind Roses
1. Division = 5%

Scale for Currents
Miles in 24 Hours

CURVES OF DIURNAL
RANGE OF PRESSURE

Compiled by W. L. Dallas.

PUBLISHED BY THE METEOROLOGICAL DEPARTMENT OF THE GOVT. OF INDIA.

PHOTOZINCOGRAPHED AT THE SURVEY OF INDIA OFFICES, CALCUTTA, FEBRUARY 1886

METEOROLOGY OF THE BAY OF BENGAL.

JUNE.

Barometric Pressure.—As in May, the lowest barometric pressure is in the north-west corner of the Bay, the highest over the Equatorial sea in the extreme south. The barometric difference between these two regions is however greater, the mean readings in the extreme north-west being now 29·57 ins. and those in the extreme S. E. 29·87 ins· showing a range of 0·3 ins.

The isobars preserve a N. E. direction across the eastern half of the Bay indicating that in the same latitude pressure is higher in the east than in the middle and rest of the Bay. In the south-west corner the pressure is higher than in the preceding month, and the isobar 29·85 ins. instead of running south-westward towards the Equator, now passes north-westward and touches the south coast of Ceylon. This barometric distribution is characteristic of the rainy season and with some modification continues throughout the months of June, July, August and September.

Winds.—The winds of this month are illustrated on the chart by 21 wind-roses. Of these the majority have a distinctly marked maximum at S. W., but in the S. W. of the Bay and over the sea to the south of Ceylon, winds from more westerly quarters are frequent, and, in wind-rose No. 15, are in excess of those from any other direction. To the north of this region, along the Coromandel Coast from Pondicherry to Masulipatam, the winds are more southerly, while in the straits of Malacca (wind-rose No. 21) there is no one dominant direction, but only a comparative absence of easterly winds. Of the 21 wind-roses 15 have the direction of maximum frequency at S. W.; 3 at S. S. W. and 2 at W. S. W. and 1 at W. Calms scarcely ever occur in the central portions of the Bay. Only in wind-roses Nos. 1, 19, 20 and 21 do the number of recorded calms reach 5 per cent. of the observations, and only in Nos. 20 and 21, in the immediate neighbourhood of Sumatra, do they exceed 10 per cent. Summing up the data of all the wind-roses the following figures are obtained illustrating the general frequency of the wind from the different directions throughout the whole Bay. The figures for May are added for comparison :—

	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calms.
May	2	2	3	5	20	41	17	4	6
June	0	1	1	3	20	51	19	2	3

Force.—There has been a decided increase of strength in the wind, the average force for the whole Bay for the present month being 4·0 as compared with 2·9 in May. The direction with the greatest mean velocity is west, and that with the least, east-north-east. The mean forces for directions, ranging from south through east to north, are with a few exceptions comparatively small, while for those in the two westerly quadrants they vary generally between 4 and 5. The wind-roses showing the greatest average force are Nos. 9 and 13, both in the centre of the Bay, and that with the lowest force is No. 20 to the south-west of Sumatra.

The following table gives the average force of the wind from all directions for each 4° square. The vertical strip in which the force is greatest is that between 84° and 88° and the transverse strip that between 8° and 12° :—

	80–84	84–88	88–92	92–96	96–100
20–		3·6	4·1	2·0	
16–20	2·9	4·2	4·8	4·2	4·1
12–16	4·1	4·4	4·6	4·0	4·2
8–12	4·4	4·6	5·0	4·2	5·2
4–8	4·3	5·0	4·5	3·9	2·7
0–4	3·9	4·4	3·6	2·3	2·0

Gales.—Generally throughout this month the S. W. monsoon winds blow strongly over the whole Bay, with cloudy and rainy weather, but in the centre of the Bay (Nos. 9 and 13) the wind seems to be steadier than nearer the land, and the percentage of gales is not so great as in some other parts. When the winds veer to W. (W. S. W. to W. N. W.) they frequently blow in heavy squalls and a larger number of gales occur with winds from these directions, than during the more common S. W. winds. As a general rule the weather is moderately fair on the east of Ceylon and Lower Coromandel Coasts, but very unsettled in the N. and N. E. of the Bay. In the neighbourhood of the Andamans there are frequent, sudden and severe squalls.

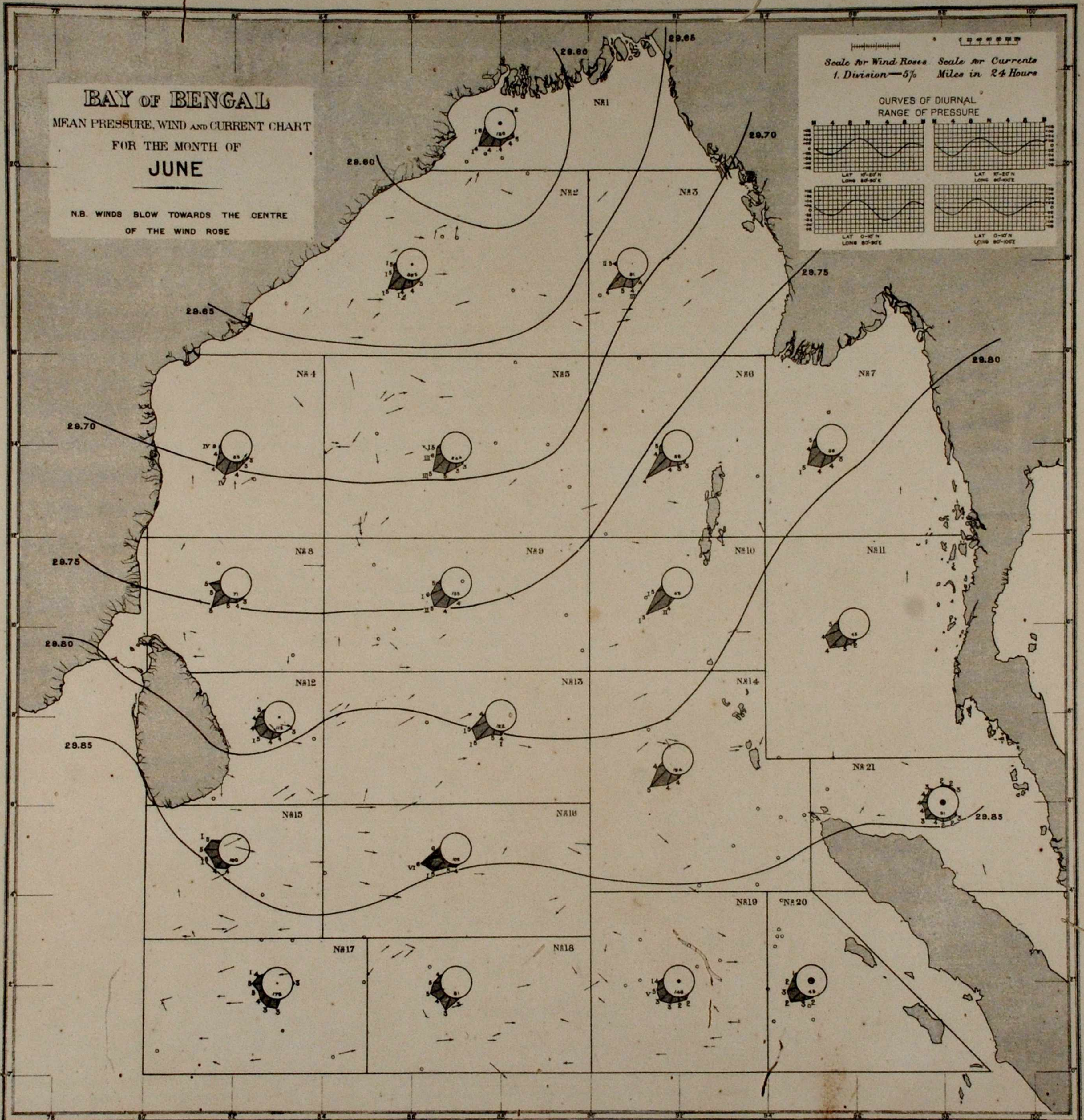
The following is the list of gales recorded in June :—

1797	June	18—20	Gale at Madras.
1822	„	?	Storm swept over Burrisal; travelling very slowly.
1823	„	2	Storm at Chittagong and Delta of Ganges.
1824	June	8	Heavy storm at Chittagong.
1839	„	3—5	Traversed the head of the Bay from S.E. to N.W. (?)
1857	„	18—30	Cyclone formed over centre of Bay; apparently travelled north-westward towards Orissa.
1859	„	12—17	Gale off Akyab.
1863	„	16—26	Cyclone formed near Acheen Head.
1869	„	5—10	Cyclone generated over north of Bay; passed over Bengal.
1870	„	20—29	Gale over centre and south of Bay.
1872	„	28	Small storm generated over north of Bay; passed over Balasore.
1873	„	10—13	Small storm formed off Coromandel Coast; apparently travelled northward.
1874	„	15—17	Small cyclone in N. W. of Bay.
1880	„	1—4	Formed over head of Bay; crossed coast near Saugor Island.
1880	„	25—30	Formed over head of Bay; crossed Orissa coast near Pooree.
1881	„	1—5	Formed over head of Bay; advanced northward to Sunderbuns.
1881	„	5—9	Generated in N.W. angle of Bay; advanced across Orissa.
1881	„	13—19	Formed over head of Bay; crossed coast near Balasore.

Currents.—To the south of Ceylon between the Equator and lat. 4° there exists a slight outset from the Bay as a westerly current, but to the north of lat. 4° there is a distinct easterly set. After passing round the S. E. of Ceylon this easterly current turns to N. E. towards the centre of the Bay (lats. 6° to 10°). Here it apparently divides, part running to the S. E. towards the Sumatra coast, and part eastward to the Nicobars. Over the head of the Bay and on the eastern side, the current is generally easterly or east-north-easterly, but in the west of the Bay between lats. 10° and 16° it is very variable and not infrequently towards some southerly quarter. Between the Tenasserim Coast and the Andamans there are signs of a weak northerly current.

The following are the figures on which the different wind-roses are founded :—

Number of Wind-rose.	Percentages.																
	N.	NNE.	NE.	ENE.	E.	ESE.	SE.	SSE.	S.	SSW.	SW.	WSW.	W.	WNW.	NW.	NNW.	Calms, &c.
1	0·9 2·2	... ...	2·8 2·3	2·4 2·4	0·9 2·3	1·0 5·0	7·6 4·9	5·3 3·8	14·6 4·4	18·2 4·0	32·7 4·1	4·3 5·5	2·1 4·8	0·4 3·5	0·9 6·0	0·1 5·0	5·8
2	... ...	... ...	0·1 2·0	... ...	0·8 1·7	0·8 3·3	1·1 3·7	5·7 3·2	14·4 3·7	23·9 4·2	36·8 4·8	8·0 5·3	4·9 5·3	0·4 5·7	0·6 2·9	... ...	2·5
3	1·1 2·5	0·3 2·0	... ...	... ...	... ...	1·1 2·0	0·2 4·0	4·5 3·5	17·9 4·1	18·9 4·5	42·7 4·4	1·9 5·6	8·7 4·6	0·2 9·0	0·5 5·0	0·2 6·0	1·8
4	1·2 7·0	... ...	0·4 4·0	0·2 2·0	... ...	0·4 1·0	3·0 2·8	5·9 3·2	18·2 3·9	30·6 4·2	28·3 4·3	5·8 4·3	3·6 8·8	1·2 3·0	... ...	... ...	1·2
5	... ...	0·4 3·0	0·4 1·0	... ...	... ...	0·6 3·5	1·3 4·4	4·3 2·8	9·9 3·4	25·3 4·6	35·0 4·9	12·5 5·7	6·6 5·4	1·7 4·2	0·2 4·5	0·1 6·0	1·7
6	... ...	... ...	... ...	... ...	... ...	... ...	... ...	5·6 3·3	7·9 3·4	12·9 3·9	60·9 4·4	8·2 3·8	4·5 4·8	... ...	... ...	... ...	...
7	... ...	... ...	... ...	... ...	... ...	... ...	... ...	3·3 2·9	12·4 3·7	28·3 4·0	38·1 4·8	13·7 4·4	3·9 4·6	... ...	... ...	... ...	0·3
8	... ...	... ...	... ...	... ...	... ...	... ...	2·1 3·0	3·5 3·3	7·7 4·0	10·4 4·9	37·2 5·1	11·5 4·5	24·0 5·1	0·4 2·0	1·8 4·5	0·7 4·0	0·7
9	0·7 7·0	... ...	0·1 7·0	... ...	... ...	... ...	0·9 2·5	... ...	4·4 3·6	22·5 4·3	33·1 5·0	25·2 5·6	7·9 5·1	2·4 4·2	2·0 5·2	0·6 5·0	0·2
10	... ...	... ...	... ...	... ...	... ...	... ...	1·3 2·0	1·6 1·5	1·6 2·8	19·7 4·1	59·3 4·8	14·1 5·2	0·8 5·5	0·8 9·0	... ...	... ...	0·8
11	... ...	... ...	... ...	... ...	... ...	... ...	... ...	0·7 4·0	5·9 2·4	16·7 4·7	37·6 4·4	31·3 4·2	7·2 5·0	... ...	... ...	... ...	0·6
12	... ...	... ...	1·3 2·0	... ...	0·1 2·0	... ...	3·1 2·8	1·3 2·3	6·1 3·6	17·2 4·2	23·0 4·6	24·1 4·0	13·6 3·9	4·8 4·7	1·0 3·7	... ...	4·4
13	... ...	... ...	1·2 3·5	... ...	0·2 9·0	... ...	0·9 9·0	0·4 1·0	9·3 4·2	9·5 5·1	38·8 5·3	33·5 5·4	4·2 4·4	0·5 5·0	0·5 3·5	0·3 4·0	0·8
14	... ...	... ...	... ...	... ...	... ...	... ...	0·4 2·5	2·3 2·7	9·1 3·5	25·3 3·9	47·9 4·5	11·2 4·0	2·1 4·3	... ...	... ...	.. ...	1·7
15	... ...	... ...	... ...	... ...	... ...	... ...	... ...	1·0 3·0	2·3 3·9	10·3 4·0	20·8 4·2	17·8 5·2	28·5 5·1	17·3 5·1	0·6 4·5	0·9 4·0	0·5
16	... ...	... ...	... ...	... ...	... ...	... ...	... ...	1·0 2·0	5·7 3·7	8·3 4·5	32·8 4·9	45·5 5·5	5·4 5·7	0·5 5·0	0·8 2·5	... ...	...
17	... ...	... ...	0·2 1·0	0·6 1·3	3·7 2·7	0·2 4·0	1·4 3·0	1·3 3·4	18·1 3·3	19·3 3·2	15·1 3·8	8·9 5·1	18·8 4·6	7·8 4·3	1·4 3·5	... ...	3·2
18	... ...	... ...	... ...	... ...	... ...	1·9 1·5	1·3 4·0	1·2 3·0	5·2 2·8	27·9 3·2	17·2 4·3	25·5 4·6	14·5 5·0	3·7 4·0	0·6 3·0	... ...	1·0
19	0·1 1·0	0·7 2·0	1·1 1·3	... ...	0·1 1·0	2·2 1·3	1·6 1·9	8·1 2·2	9·8 2·2	16·6 2·9	23·4 3·0	16·1 4·9	9·4 3·9	1·2 1·6	0·5 2·0	0·3 1·0	8·8
20	1·1 3·0	1·5 1·0	0·8 1·0	... ...	0·7 1·0	... ...	2·2 2·5	0·7 1·0	3·3 2·0	12·0 2·7	28·7 2·3	22·1 2·7	7·6 1·8	3·7 1·3	1·5 1·0	0·4 1·0	13·7
21	4·7 1·9	3·3 2·3	3·8 2·5	... ...	0·8 2·0	0·4 1·0	6·2 2·5	6·6 2·3	7·1 2·2	5·5 3·6	16·1 2·8	9·4 3·8	12·5 4·4	4·0 3·[illegible]	6·7 3·3	0·4 4·0	12·5

# BAY OF BENGAL

MEAN PRESSURE, WIND AND CURRENT CHART
FOR THE MONTH OF
JUNE

N.B. WINDS BLOW TOWARDS THE CENTRE OF THE WIND ROSE

Compiled by W. L. Dallas.

PUBLISHED BY THE METEOROLOGICAL DEPARTMENT OF THE GOVT. OF INDIA.

PHOTOZINCOGRAPHED AT THE SURVEY OF INDIA OFFICES, CALCUTTA, FEBRUARY [illegible]

METEOROLOGY OF THE BAY OF BENGAL.

JULY.

Barometric Pressure.—The changes in the distribution of pressure between the months of June and July are unimportant. Readings are slightly higher (29·90 ins.) over the sea to the south-west of Sumatra, but the lowest pressures (29·60 ins.) are still in the north-west corner of the Bay.

In the north of the Bay the pressure declines from the Arakan Coast westward; but this is not the case to the south of Cape Nigrais, and at the entrance of the Straits of Malacca the pressure is lower than between Acheen Head and the Nicobars.

Winds.—Over the whole of the Bay the south-west Monsoon continues to blow strongly and on the whole steadily. In the north-west, centre and east of the Bay, winds from directions other than between south-south-west and west-south-west are exceptional. The steadiest south-west winds are in the Andaman Sea and to the west of the Nicobars and Andamans, between Lat. 4° and Lat. 16°. In the west of the Bay the winds are more variable between south and west; but, still with a more or less pronounced maximum at south-west; easterly winds occur occasionally though rarely. To the south-west of Ceylon and over the Equatorial sea between 0° and 4° Lat., the prevailing winds are more westerly, and north-west winds are occasionally met with. The wind-roses in those regions show nearly uniform values for all points from south round to west. At the entrance to the Straits of Malacca the winds are very variable from the southerly points of the compass; but northerly winds are practically absent. Calms in this region are more frequent than winds from any single direction. In the centre of the Bay calms scarcely ever occur, and indeed, except in the neighbourhood of Sumatra, they are rare in any part of the Bay. Of the 22 wind-roses represented on the chart, 19 have the point of maximum frequency at south-west, 1 at south-south-west, and 2 at west-south-west.

Summing up the data of all the wind-roses the following figures are obtained:—

	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calms, &c.
June	0	1	1	3	20	51	19	2	3
July	0	0	2	3	17	56	17	2	3

These figures show in a marked manner the general preponderance of south-west winds.

Force.—The average strength of the wind throughout the whole Bay is the same as in June. The south-west winds are the steadiest, though the average strength of west-south-west winds is slightly higher. Whenever, within the Bay proper, the wind draws round to quarters between north and west, it becomes strong and squally, and on the few occasions when it has blown from points to the east of north it has also been unsteady and squally.

The following table gives the average force of the wind from all directions for each 4° square:—

	80	84	88	92	96	100
		4·4	3·9	2·0		
20	4·9	4·1	4·3	3·9	3·3	20
16	4·7	4·6	4·9	4·9	4·4	16
12	3·6	3·6	5·3	4·8	4·4	12
8	4·1	4·6	4·9	3·9	2·4	8
4	3·9	3·7	3·6	2·7	2·0	4
0						0
	80	84	88	92	96	100

The vertical strip having the greatest mean strength is that lying between Longs. 88° and 92°, and the transverse strip that lying between Lats. 12° and 16°.

Gales.—

The following list comprises all the gales recorded in July:—

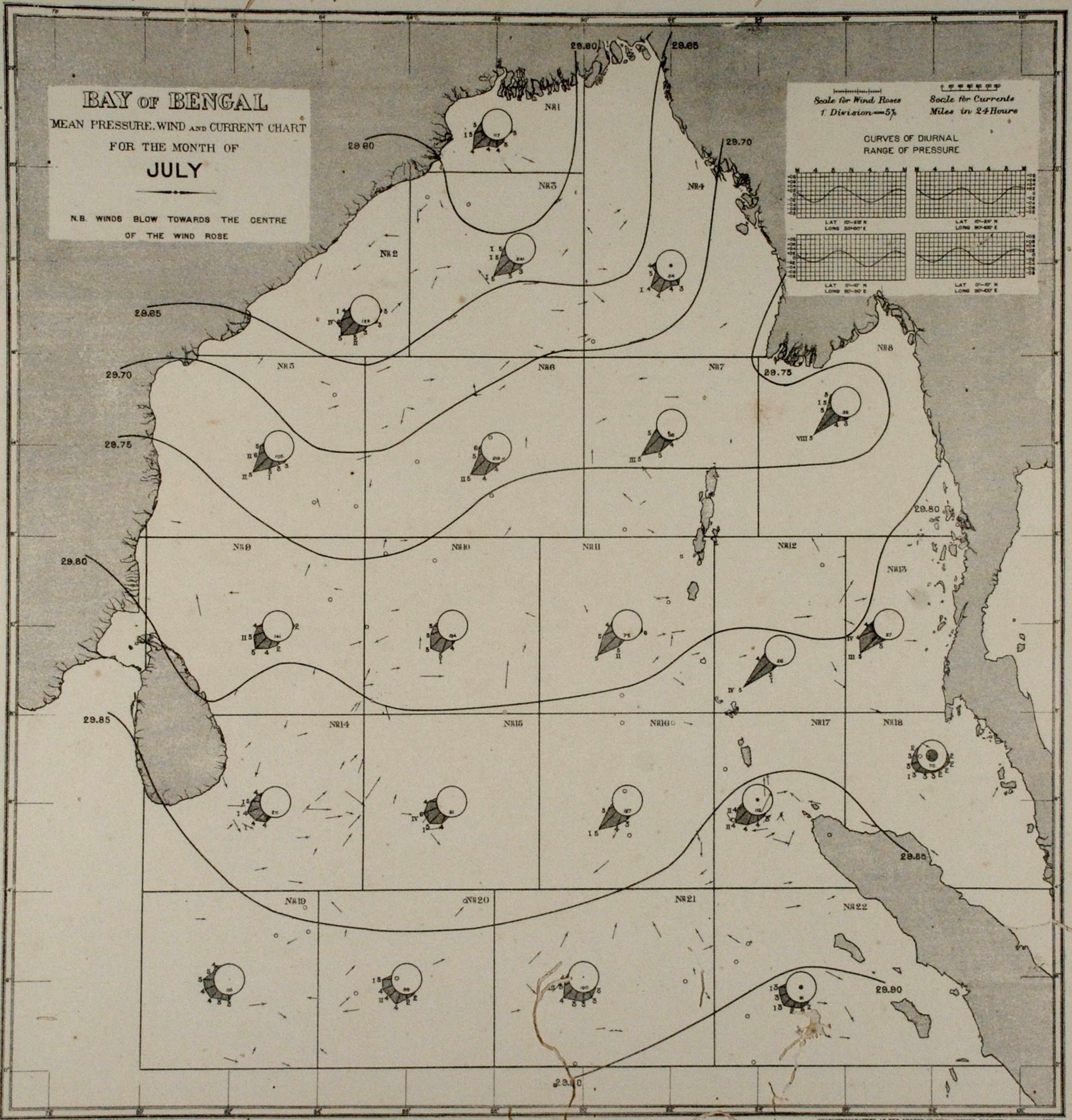
1848	July	15	Gale at the Sandheads.
1858	„	23—26	Slight gale at the head of the Bay.
1859	„	11—28	Cyclone formed to west of Nicobars; travelled north-westward.
1860	„	25—31	Gale off Ceylon and the Coromandel Coast.
1871	July	16—18	Gale in the Andaman Sea.
1872	„	14—31	Gale over the south of the Bay.
1874	„	28—29	Slight Cyclone at Sandheads.
1877	„	11—15	Cyclone formed over the head of the Bay; crossed coast at Balasore.
1878	„	20—30	Cyclone formed in north of Bay; centre crossed coast to north of Vizagapatam.
1880	„	14—17	Generated near Sandheads, travelled westward to Balasore.
1881	„	2—4	Small storm generated in north-west angle of Bay; crossed coast at Balasore.
1881	„	12—18	Formed over the head of the Bay to east of Sandheads; travelled slowly westward; crossed coast near mouth of Hughli.
1883	„	26—29	Generated over the head of the Bay on 26th; Centre crossed Orissa coast on 29th.

Currents.—An easterly current enters the Bay to the southward of Ceylon. After passing that island it sets north-eastward, and so continues as far as the centre of the Bay. Here the current apparently divides, part continuing a more or less direct course north-eastward to the head of the Bay and the Arakan coast, and part passing eastward through the Ten-degree channel towards the Malay Peninsula.

The minor currents are not very distinctly traceable. Between Point Calimere and the mouth of the Godavari the current observations are very few and hardly indicate any particular motion of the water; but on the coast of Orissa and Ganjam and also on the south-east coast of Ceylon there are return southerly currents. Round Acheen Head there is a very confused current, but to the westward of Sumatra, between Longs. 88° and 93°, the set is generally towards the north.

The following are the figures on which the wind-roses of the month are founded:—

Number of Wind-rose.	Percentages.																
	N.	NNE.	NE.	ENE.	E.	ESE.	SE.	SSE.	S.	SSW.	SW.	WSW.	W.	WNW.	NW.	NNW.	Calms, &c.
1	0·8 5·0	... ...	... ...	... ...	... ...	2·9 4·8	1·7 3·0	5·1 3·2	14·4 3·8	14·5 4·1	36·6 4·4	17·8 4·8	2·6 4·9	0·9 4·0	0·9 3·0	... ...	1·8
2	... ...	... ...	0·7 2·5	0·6 3·5	2·9 2·6	0·5 1·5	2·5 2·5	0·4 1·5	5·7 3·2	19·9 4·8	38·9 4·6	21·4 5·9	5·2 4·3	... ...	... ...	... ...	1·3
3	... ...	0·4 7·0	0·1 2·0	0·6 5·0	1·6 4·2	2·1 3·9	1·6 3·4	2·2 3·2	6·9 3·0	21·8 4·6	45·8 4·9	12·4 5·4	2·9 5·3	0·5 5·7	0·2 4·0	0·1 2·0	0·8
4	... ...	... ...	0·6 1·0	... ...	0·6 2·0	0·3 3·0	0·9 3·0	11·3 3·0	9·9 3·5	27·8 3·9	28·9 4·1	3·5 4·5	9·3 3·9	0·9 3·0	... ...	... ...	6·0
5	0·5 2·0	0·5 4·0	... ...	1·4 5·5	2·1 5·3	1·0 5·0	2·4 3·0	2·9 3·0	5·2 3·1	17·5 4·8	44·1 5·1	13·5 5·8	7·3 5·0	0·3 4·0	... ...	... ..	1·3
6	0·5 2·0	... ...	... ...	0·2 4·0	0·6 4·0	1·5 3·5	1·9 2·6	0·4 3·5	6·7 3·8	27·3 4·4	44·9 5·1	9·0 5·4	5·0 6·1	1·0 5·6	0·5 7·0	... ...	0·5
7	... ...	... ...	... ...	... ...	... ...	... ...	1·0 3·5	... ...	3·3 4·4	27·9 4·7	58·4 4·9	6·5 4·7	1·9 5·0	0·4 5·0	0·6 6·0	... ...	...
8	... ...	... ...	0·3 3·0	... ...	0·3 1·0	... ...	0·4 5·0	1·5 2·0	5·5 3·1	10·4 3·7	62·5 5·0	10·6 4·7	4·2 4·6	2·8 6·3	... ...	... ...	1·5
9	... ...	0·1 2·0	... ...	... ...	2·8 2·3	0·2 1·0	2·4 2·4	1·3 1·3	7·3 2·0	17·9 3·7	33·3 4·5	22·3 5·2	9·7 4·1	0·3 2·0	0·1 5·0	0·2 7·0	2·1
10	... ...	... ...	0·2 5·0	... ...	1·7 5·0	0·7 3·0	1·7 2·7	0·6 3·0	7·8 3·9	27·7 4·9	33·1 4·8	18·1 4·8	6·4 4·8	1·5 5·3	0·5 1·0	... ...	...
11	... ...	... ...	... ...	... ...	... ...	2·8 5·5	... ...	... ...	0·8 3·0	15·2 4·8	55·3 5·0	23·2 5·0	2·5 3·8	0·2 7·0	... ...	... ..	...
12	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	13·7 5·1	75·7 5·1	10·6 3·6	... ...	... ...	... ...	... ...	...
13	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	5·5 5·3	51·3 4·6	33·8 4·1	9·4 3·9	... ...	... ...	... ...	...
14	... ...	... ...	... ...	... ...	0·5 2·0	0·6 4·0	1·0 1·9	1·0 2·2	1·6 2·9	13·0 4·2	23·9 4·3	29·6 4·0	18·2 5·0	6·7 4·1	2·2 2·7	0·4 4·0	1·3
15	0·6 4·0	... ...	... ...	... ...	1·2 1·0	... ...	... ...	... ...	0·6 3·0	17·6 4·4	31·5 5·4	30·4 5·8	16·1 4·2	1·0 2·5	0·4 1·0	0·6 5·0	...
16	... ...	... ...	... ...	... ...	... ...	... ...	1·2 2·0	1·9 3·3	6·5 3·3	23·4 3·8	50·7 5·0	11·8 5·0	0·5 4·5	1·6 7·5	0·3 9·5	0·8 7·0	1·3
17	... ...	... ...	0·5 2·0	... ...	... ...	0·4 2·0	1·5 4·8	3·1 3·0	12·2 3·6	24·6 3·9	34·1 4·0	14·5 4·2	2·1 4·5	... ...	... ...	... ...	7·0
18	1·9 2·0	... ...	0·5 1·0	1·7 1·0	2·9 1·5	7·5 2·2	4·0 2·4	2·7 2·0	3·6 2·5	7·2 3·4	15·7 3·3	15·1 2·7	8·0 2·5	3·7 1·8	0·9 1·3	... ...	24·6
19	... ...	... ...	... ...	... ...	... ...	... ...	... ...	0·9 4·0	11·8 2·8	12·0 3·3	20·7 3·7	21·8 4·2	21·3 4·8	4·7 4·5	6·3 4·3	... ...	0·5
20	... ...	... ...	... ...	... ...	1·0 2·	1·0 2·0	1·0 2·0	2·9 2·4	8·5 2·3	24·4 3·6	18·4 4·0	21·5 4·1	18·4 4·9	2·4 3·7	0·5 3·0	... ...	...
21	0·5 1·0	0·1 1·0	0·1 1·0	... ...	... ...	... ...	2·6 2·9	14·7 3·0	17·5 3·0	18·4 3·0	25·7 3·8	10·9 5·1	5·2 4·3	0·8 4·0	0·8 3·7	0·3 1·0	2·4
22	2·0 1·3	... ...	... ...	0·4 1·0	1·3 1·4	1·8 2·0	2·1 1·7	4·7 1·8	10·4 1·8	13·4 2·4	20·8 2·9	15·8 3·4	14·9 3·0	1·4 5·5	2·0 3·3	0·7 1·0	8·3



BAY OF BENGAL

MEAN PRESSURE, WIND AND CURRENT CHART
FOR THE MONTH OF

JULY

N.B. WINDS BLOW TOWARDS THE CENTRE OF THE WIND ROSE

Scale for Wind Roses
1 Division = 5%

Scale for Currents
Miles in 24 Hours

CURVES OF DIURNAL RANGE OF PRESSURE

Compiled by W. L. Dallas.

PUBLISHED BY THE METEOROLOGICAL DEPARTMENT OF THE GOVT. OF INDIA.

PHOTOZINCOGRAPHED AT THE SURVEY OF INDIA OFFICES, CALCUTTA, FEBRUARY 1886.

METEOROLOGY OF THE BAY OF BENGAL.

AUGUST.

THE gradual fall of the barometer which is in progress throughout the Bay during the first six months of the year ceases in July and is followed by a slight recovery in August. The isobar of lowest value is now 29·65 ins., enclosing the north-west corner of the Bay. Over the central region pressures differ but little from those of July, but those in the south are higher. The difference between the north and south of the Bay is now 0·25 in., but, except that the barometric gradient is slightly less, the general distribution of pressure remains the same as during the earlier period of the rains. The highest pressure is in the Equatorial sea to the south of Ceylon. To the east of longitude 92° in the north of the Bay and of longitude 96° in the south, the lines of equal pressure turn somewhat abruptly northward, indicating that under the same latitudes, pressure is higher in the eastern than in the western half of the Bay.

Winds.—With few exceptions the predominant wind direction is south-westerly. To the south of Ceylon the winds vary between W.N.W. and South, with a slight maximum at west-south-west, further to the east, but in the same latitude they vary all round the two southern quadrants with a predominance of winds between south and west; but still further to the east in the neighbourhood of Sumatra they are steadier from S.W. or S.S.W. In the Straits of Malacca the winds are very variable, blowing from all quarters, except between N.E. and N.W. and with a slight maximum at W.S.W. All over the middle of the Bay, as well as in the north-west corner, south-west winds are greatly in excess, amounting in the former to more than half of the whole number of recorded observations. Along the west coast of the Bay; this preponderance is less pronounced, and winds from all directions between W. and S. are nearly equally prevalent.

Calms.—Calms are seldom experienced, except in the Andaman sea and off Sumatra, and even in wind-roses Nos. 9, 10, 14 and 18 the number of variable airs and calms bears but a small proportion to the number of south-west (south to west) winds.

Summing up the data of all the wind-roses, the following results are obtained, illustrating the relative frequency of the winds from all directions throughout the whole Bay. The figures for July are added for comparison.—

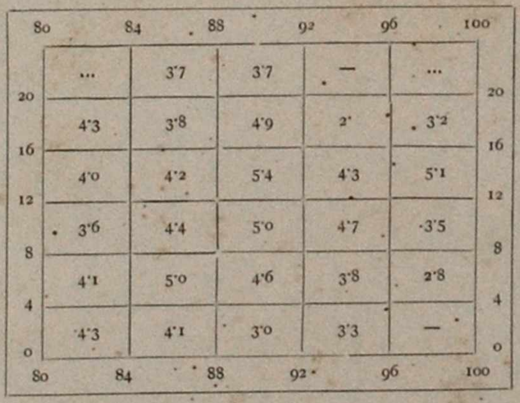
	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calms, &c.
July	0	0	2	3	17	56	17	2	3
August	1	1	2	6	17	52	16	1	4

These results show that the S.W. winds are somewhat less steady than in July. Winds from north and north-east amount to 2 per cent., and calms have risen 1 per cent.

Force.—The average force of the wind is the same as in July: and, as in the two previous months, W.S.W. winds have the greatest mean force. The region within which the winds from all directions have the greatest force is that illustrated by wind-roses Nos. 5 and 8, where the means are 5·4 and 5·3 respectively.

The following diagram gives the average force for each four degree square. The verticle strip in which the force is greatest is that between longitudes 88° and 92°, and the transverse strip that between latitudes 12° and 16°:—

AUGUST.



Gales.—

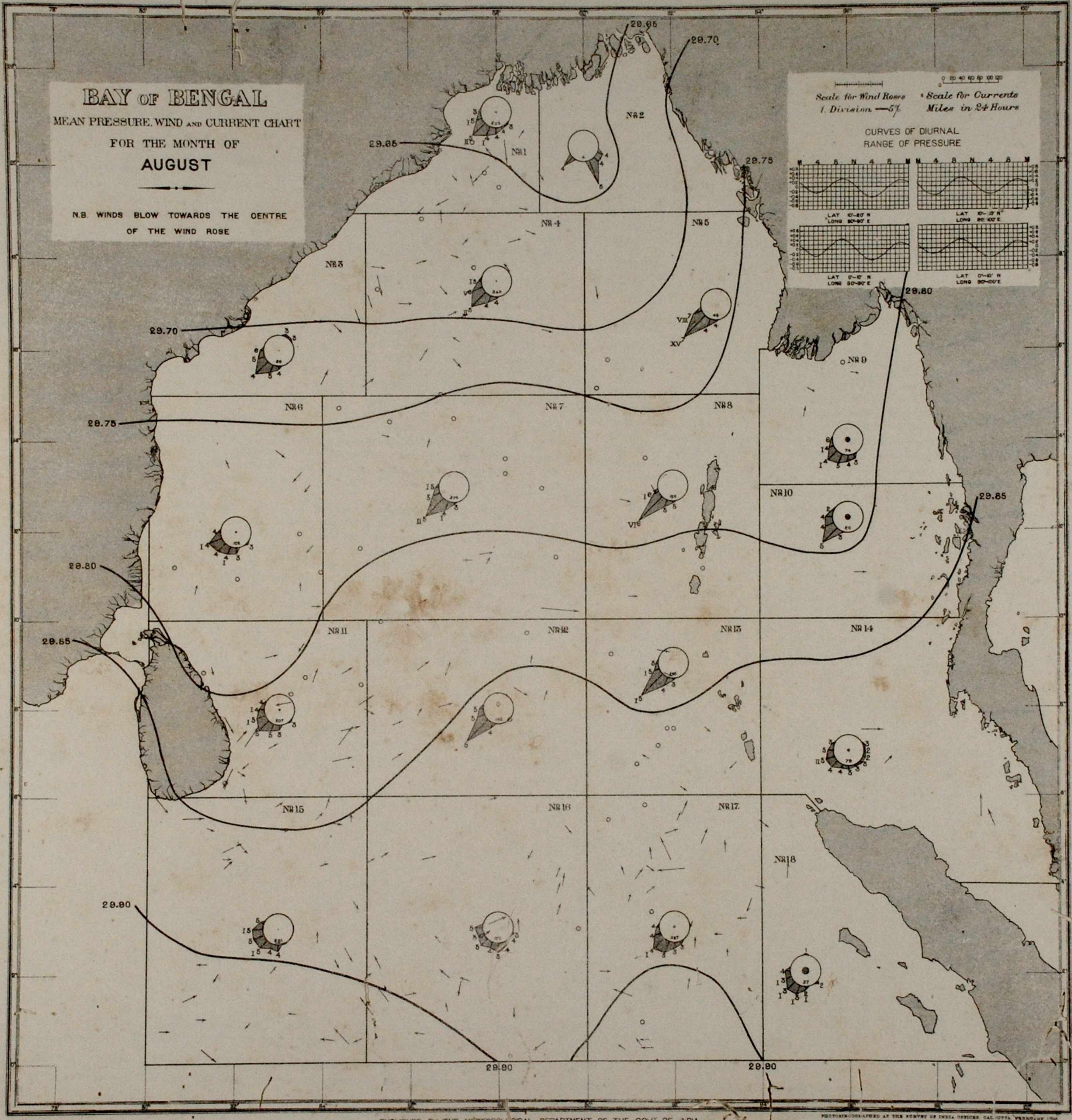
The following is a complete list of all the recorded gales of the month of August:—

Year.	Day.	
1834	3	Gale at Calcutta.
1844	21	Cyclone at Calcutta.
1857	9—17	Gale over the northern half of the Bay.
1857	18—19	Gale over the centre of the Bay.
1859	25—31	Storm formed in about latitude 7°, longitude 90° and travelled northward to latitude 12°.
1861	17—21	Slight gale over the head of the Bay.
1862	9—12	Gale over the centre of the Bay.
1863	10—11	Formed in the centre of the Bay to the westward of the Andamans.
1863	28—31	Gale in the extreme south.
1865	16—25	Gale over the northern parts of the Bay.
1873	3—6	Formed over the centre of the Bay, travelled N.N.W.
1874	1	Cyclone crossed the north of the Bay from near Akyab, travelling west-north-westward.
1877	5—12	Small cyclone formed over head of the Bay and advanced northwards over Jessore.
1877	13—17	Small cyclone formed over the head of the Bay, travelled North.
1877	18—21	Small cyclone formed near Arakan coast travelled N.N.W. and crossed coast at Sunderbuns.
1877	27—31	Small cyclone formed over head of Bay, travelled north-westward to Balasore.
1878	1—4	Developed over head of Bay, crossed Orissa coast to South of False Point.
1878	6—8	Formed in N.W. angle of Bay, travelled to Balasore.
1879	8—13	Generated in N.W. angle of Bay, crossed coast at Balasore.
1880	1—9	Formed over the head of Bay, travelled in a W.N.W. direction.
1880	18—25	Formed over the head of the Bay, travelled north-westward.
1881	1—4	Developed in N.W. of Bay, crossed coast near False Point.
1881	16—19	Formed in N.W. of Bay, crossed coast at Balasore.

Currents.—An easterly current prevails in the Equatorial sea to the south of Ceylon. After passing that Island, it curves north-east and flows in that direction towards the centre of the Bay. In the extreme south of the Bay, except immediately to the south of Ceylon, there is a west to north-west current, and a little to the North between longitude 89°, and Acheen Head a well defined northerly set. Over the centre of the Bay to the northward of latitude 12°, there is apparently very little movement.

A southerly current runs, down the east coast of Ceylon close inshore, and there is a southerly (S.S.E. and S.S.W.) set along the north-west coast of the Bay from the Sandheads as far as Vizagapatam,

Number of Wind-rose.	Percentages.																
	N.	NNE.	NE.	ENE.	E.	E.S.E.	SE.	SSE.	S.	SSW.	SW.	WSW.	W.	WNW.	NW.	NNW.	Calms, &c.
1	1·3 2·5	0·3 5·0	0·2 1·0	0·1 2·0	1·1 3·0	0·6 2·3	2·8 2·9	4·4 4·3	13·3 3·7	20·1 4·1	35·3 4·5	11·6 5·4	3·9 3·3	0·6 2·5	0·9 3·3	0·2 3·0	3·3
2	... ...	... ...	... ...	... ...	... ...	12·5 4·0	12·5 4·0	50·0 4·5	... ...	... ...	25·0 4·0	... ...	... ...	... ...	... ...	... ...	...
3	2·2 3·0	4·0 2·5	2·7 2·8	2·2 2·0	1·3 1·0	0·9 2·0	1·4 1·5	0·4 1·0	6·6 4·3	16·8 4·5	35·8 4·0	14·9 4·5	7·7 6·4	... ...	... ...	2·2 1·5	0·9
4	0·2 2·5	0·2 4·0	0·9 3·1	0·5 1·8	2·0 1·7	1·3 1·9	1·5 3·0	1·1 2·7	4·4 3·6	15·1 4·4	41·7 5·4	22·6 6·1	5·8 5·3	0·8 5·4	0·4 3·6	... ...	1·5
5	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	3·5 3·5	16·6 4·3	60·3 6·6	19·6 7·3	...	... ...	... ...	... ...	...
6	... ...	... ...	... ...	... ...	0·3 1·0	0·9 4·0	3·3 2·9	2·0 2·0	12·7 3·3	16·0 3·8	23·6 4·1	28·4 4·1	6·5 3·6	2·2 2·3	0·8 4·0	... ...	3·3
7	... ...	... ...	... ...	0·1 1·0	0·3 1·0	... ...	0·7 2·5	0·6 2·8	3·8 3·2	20·3 4·3	50·2 5·1	16·1 4·9	5·5 5·4	0·7 3·8	0·9 5·8	0·1 2·0	0·7
8	... ...	... ...	... ...	... ...	... ...	... ...	... ...	0·3 3·5	3·5 4·6	14·6 4·6	68·9 5·5	10·1 5·7	0·9 5·0	1·0 4·5	0·2 9·0	... ...	0·5
9	... ...	... ...	... ...	... ...	... ...	... ...	2·2 2·5	9·7 3·3	13·7 4·0	20·7 4·5	26·1 4·1	10·4 3·6	3·2 5·7	2·1 5·0	0·5 6·5	... ...	11·4
10	... ...	... ...	... ...	... ...	... ...	... ...	0·8 2·0	... ...	1·6 2·0	3·8 3·0	41·7 5·1	19·1 4·4	15·5 4·4	3·7 1·5	1·7 8·0	... ...	12·1
11	0·4 1·5	0·2 1·0	0·2 2·0	0·1 2·0	0·9 2·2	1·5 2·7	2·8 2·7	1·4 3·1	10·8 2·7	15·9 4·5	28·4 4·7	19·8 4·7	10·4 4·2	2·8 3·5	1·6 3·8	0·3 5·0	2·5
12	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	2·0 4·0	12·4 4·3	62·5 5·1	15·0 5·3	8·1 5·1	... ...	... ...	... ...	...
13	... ...	... ...	... ...	... ...	... ...	... ...	0·3 1·0	... ...	3·1 3·1	19·3 3·9	61·3 4·8	11·4 4·9	3·0 3·3	... ...	0·7 5·0	... ...	0·9
14	1·9 2·3	0·6 3·0	1·0 2·5	3·5 2·5	2·6 2·0	5·2 1·9	5·6 2·6	3·3 2·5	6·9 2·5	8·5 4·0	17·1 4·2	19.2 4·6	11·6 5·0	3·3 3·0	1·4 1·7	0·8 3·5	7·5
15	0·1 5·0	... ...	... ...	... ...	0·1 5·0	... ...	0·1 2·0	2·1 3·1	13·0 3·5	10·6 3·7	20·9 4·8	23·0 5·1	22·1 5·1	6·5 4·0	... ...	... ...	1·5
16	... ...	... ...	... ...	... ...	1·4 3·3	3·1 3·4	2·5 3·7	9·6 3·7	19·2 3·0	12·1 3·7	19·8 4·5	12·3 4·9	15·9 4·8	1·8 5·6	0·1 1·0	... ...	2·2
17	0·9 3·5	... ...	... ...	... ...	... ...	0·1 4·0	2·2 2·4	5·4 2·9	11·1 2·8	24·4 3·4	30·4 3·6	13·0 3·9	4·7 4·4	1·6 5·9	1·1 2·3	0·3 4·0	4·8
18	3·2 1·0	... ...	... ...	... ...	... ...	2·2 1·5	5·4 2·0	2·3 2·3	6·5 2·3	19·6 2·8	21·8 3·3	12·2 3·3	11·0 3·5	1·3 6·0	... ...	... ...	14·5



BAY OF BENGAL
MEAN PRESSURE, WIND AND CURRENT CHART
FOR THE MONTH OF
AUGUST

N.B. WINDS BLOW TOWARDS THE CENTRE
OF THE WIND ROSE

Scale for Wind Roses
1. Division — 5%

Scale for Currents
Miles in 24 Hours

CURVES OF DIURNAL
RANGE OF PRESSURE

Compiled by W. L. Dallas.

PUBLISHED BY THE METEOROLOGICAL DEPARTMENT OF THE GOV^T OF INDIA.

PHOTOZINCOGRAPHED AT THE SURVEY OF INDIA OFFICES, CALCUTTA, FEBRUARY [illegible]

METEOROLOGY OF THE BAY OF BENGAL.

SEPTEMBER.

THE barometer is higher than in August throughout the greater part of the Bay. The change amounts to 0·05 inch in the north, but to only a few thousandths in the centre and south. The highest pressures hold steadily over the Equatorial Sea to the south of the Bay, and, in the north, the observations show a region of low barometric readings over the head of the Bay. This is shown on the chart enclosed by the isobar 29·70 inches, and readings within it are lower than in any other part of the Bay or the adjacent coasts. The effect of this distribution on the winds of this region will be noticed presently.

Within this low pressure area or a little to the south of it are generated most of the small storms which are felt at the head of the Bay at this season, and a large percentage of all the gales recorded on the chart occur in this neighbourhood.

With this important exception, the general distribution of the lines of equal pressure is not very dissimilar to that of the preceding month. The isobars over the more central regions run generally across the Bay from south-west to north-east, while those in the south run approximately in an east and west direction. On the eastern side of the Bay the pressure is very uniform in the Gulf of Martaban and down the coast of Tenasserim, and it is probably to this distribution that the quiet settled weather and the low wind-force of this region are attributable.

Winds.—The south-west monsoon blows moderately all over the Bay, the mean force being 3·5 as compared with 3·9 in July and 3·8 in August. In some parts, the wind is less steady than in the preceding months, and north-west and west-north-west winds occur at times all over the Bay, but particularly in the areas illustrated by the wind-roses Nos. 3, 5, and 6. Notwithstanding these occasional interruptions, the south-west wind is still the prevailing current over the greater part of the Bay, and in the central region, *i.e.*, between Longs. 84° and 94° it blows with great steadiness.

Towards the head of the Bay this steadiness rapidly decreases, and, in District No. 3, winds blow from all quarters from west-north-west through south to east with a slight maximum at south-west. Still further north, about the Sandheads, easterly and north-easterly winds become of appreciable frequency. These north-east winds are also felt occasionally on the Orissa and Northern Circars Coasts, nearly down to Masulipatam. They do not extend far from the shore towards the centre of the Bay. They may be regarded as the first appearance of the winter monsoon.

On the coast between the Godavary and Madras, the observations show an absence of winds between north and east and a slight maximum at south and south-west; in other respects the winds are very variable. Still further south, between Madras and the north point of Ceylon, there is a decided preponderance of south-west winds, but also frequent shifting to south and west; while, off the east coast of Ceylon, the wind is variable between west and south. Over the Equatorial Sea to the south of the Bay, the winds blow almost uninterruptedly from between west and south, but are very variable within those limits, and more particularly in the neighbourhood of the Equator. In the Straits of Malacca the winds vary generally between west and west-north-west. On the lower Tenasserim Coast strong, squally westerly winds are very prevalent, while on the upper Tenasserim Coast the winds are more south-westerly; but almost equally strong and squally. In the Gulf of Martaban, the maximum frequency is at south-west; but north, north-west and south winds also occur. On the Arakan Coast, south is the most frequent wind-direction but with frequent shifts to south-west and occasional breezes from north-north-east.

Summing up the data of all the wind-roses the following results are obtained. The figures for August are added for comparison:—

	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calms, &c.
August	1	1	2	6	17	52	16	1	4
September	2	1	1	4	15	46	22	4	5

The wind-rose with the greatest average force is No. 19, and that with the lowest No. 9 (in the Gulf of Martaban); while, on the average of the whole Bay, the wind with the highest mean strength is west-south-west as in previous months. The following diagram gives the mean force of the wind, irrespective of direction, for each 4° square:—

	80–84	84–88	88–92	92–96	96–100
		3·0	3·0	—	
20–16	2·7	3·1	3·7	3·7	1·8
16–12	3·4	4·2	4·0	3·4	3·9
12–8	3·4	4·2	4·5	4·4	5·6
8–4	3·8	4·8	3·8	3·2	3·5
4–0	4·4	4·0	3·6	2·9	3·0

In the transverse strips the force is greatest between lat. 8° and 12° and in the vertical strips (omitting the observations to the north of lat. 20°) the maximum force throughout is between longs. 84° and 88°.

Gales.—Gales are not infrequent. The regions within which they are most common are:—the upper centre of the Bay between lats. 13° and 20°, and longs. 86° and 90°; the neighbourhood of the Andamans and, along the Tenasserim Coast from lat. 13° down to the Straits of Malacca. In the latter region, most of the strongest winds are recorded from west-south-west.

The following is a list of the gales found recorded in the month of September:—

1808—September	5th—6th, Cyclone at Vizagapatam.
1839— "	19th—21st, Cyclone passed northwards across Sunderbuns between Calcutta and Burrisal.
1846— "	21st, Gale at Calcutta.
1867— "	30th, Cyclone at Vizagapatam.
1872— "	11th, Small cyclone in north-east of the Bay.
1872— "	19th—20th, Small storm in the north of the Bay.
1877— "	5th—11th, Storm generated over head of the Bay; travelled west-north-west to Balasore.
1878— "	13th—21st, Cyclone originated over head of the Bay; travelled to False Point.
1878— "	18th—24th, Cyclone formed over head of the Bay, near Arrakan Coast; travelled north-westward and crossed Sunderbuns.
1879— "	12th—17th, Storm formed in north of Bay; probably near Arrakan Coast, travelled westward.
1879— "	21st—28th, Storm generated near Arrakan Coast, travelled westward, struck coast, near Pooree.
1880— "	12th—19th, Storm formed in lat. 19° and crossed the coast near Gopalpore.
1880— "	21st—26th, Slight storm over the head of the Bay; advanced to Balasore.
1881— "	10th—14th, Storm developed over head of Bay; crossed coast near False Point.

Calms.—Calms are much more frequent than in August, particularly in the upper part of the Bay, on the Ganjam and Arakan Coasts, also off the east coast of Ceylon and in the Straits of Malacca.

Currents.—The southerly (south-west and south-east) or long-shore current still prevails down a large part of the western side of the Bay close in shore. On the Orissa and Ganjam Coasts it is very decided, owing partly to the large out-flow of water from the Gangetic mouths and partly to the north-east winds, noticed above. This current is less strongly marked on the Coromandel Coast, but re-appears very prominently on the east coast of Ceylon. Over the centre and a great part of the south of the Bay, as well as over a large part of the Equatorial Sea to the south, the set of the water is almost entirely to the eastward; but there are two exceptions, a distinct north-east current prevailing in the upper part of the Bay in long. 90° and a very decided south-east current to the westward of Sumatra. Off Acheen Head the current is very confused. To the south of Ceylon between lats. 3° and 6°, there is a moderate easterly current, but further to the southward between the Equator and lat. 3° the set is also confused:—

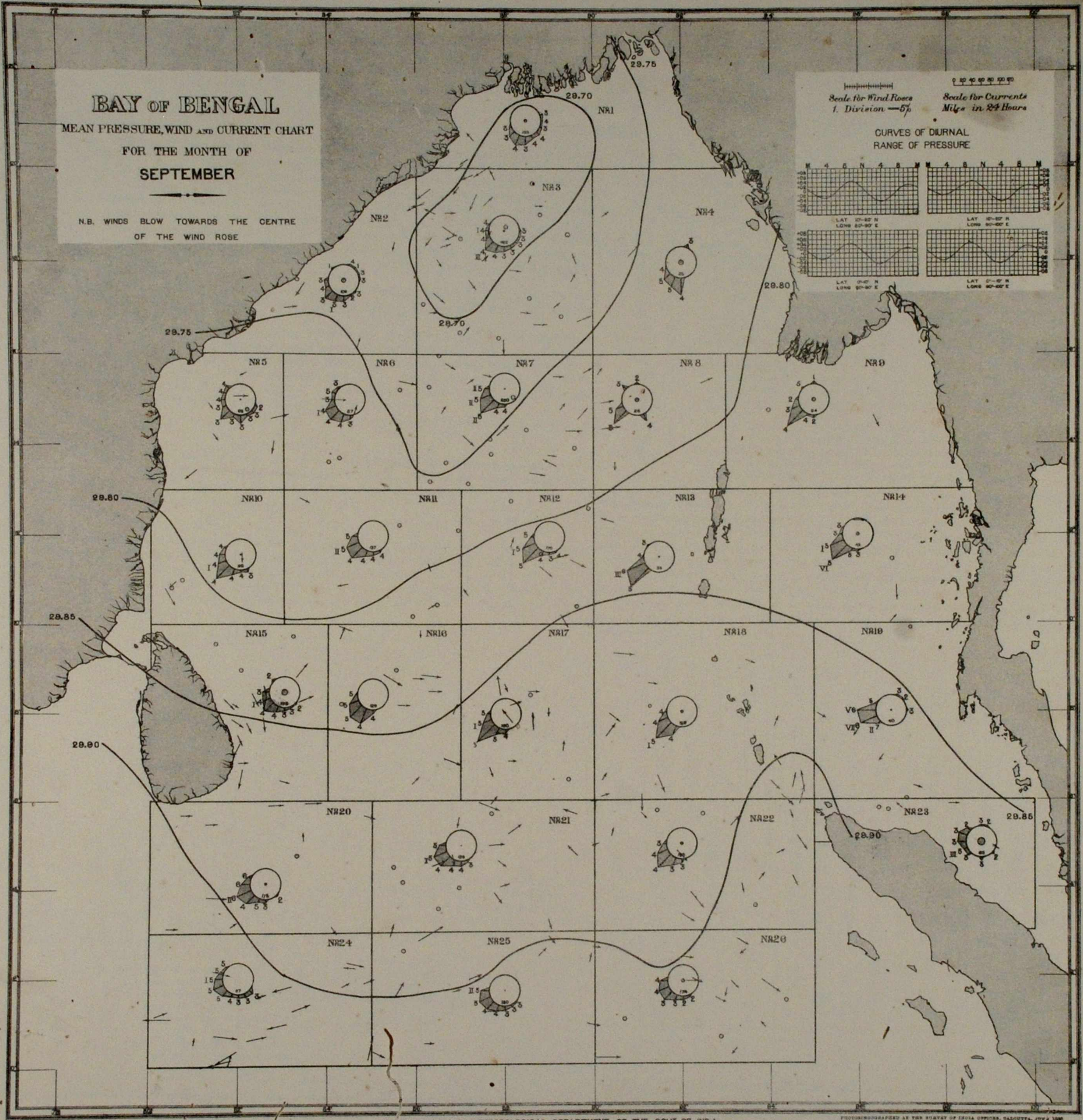
Number of wind-rose.	Percentages.																
	N.	NNE.	NE.	ENE.	E.	ESE.	SE.	SSE.	S.	SSW.	SW.	WS W	W.	WNW.	NW.	NNW.	Calms, &c.
1	1·9 2·5	0·2 1·0	0·5 1·5	5·6 3·2	3·1 3·5	4·6 2·7	8·6 3·9	7·1 3·8	16·0 3·2	21·3 3·6	14·5 3·1	4·7 3·3	1·7 2·9	1·1 2·3	2·0 1·6	0·4 3·0	6·7
2	1·6 2·0	2·7 3·5	3·4 1·2	2·5 2·6	2·8 2·8	1·4 1·7	3·0 3·2	3·0 2·2	11·5 2·5	14·3 3·4	21·3 2·8	8·8 4·3	9·4 3·2	0·5 3·0	3·1 1·3	.. ...	10·7
3	1·5 2·3	0·4 2·8	1·5 2·4	1·3 3·1	2·5 3·4	3·7 3·1	4·8 2·8	6·1 2·9	10·8 2·8	15·5 4·2	24·4 4·4	9·0 4·0	7·8 3·5	2·9 4·3	2·2 3·4	0·7 2·3	4·9
4	1·3 3·0	7·3 3·0	... ...	... ...	... ...	... ...	... ...	2·0 4·0	34·7 3·8	21·3 5·0	18·0 4·9	3·0 3·5	1·7 6·0	... ...	... ...	... ...	10·7
5	0·8 3·0	... ...	0·4 1·0	... ...	0·5 2·0	5·9 1·8	6·1 3·4	4·1 3·3	16·9 3·1	6·4 3·0	25·0 3·0	7·7 3·2	8·5 3·7	5·2 4·1	9·8 3·9	... ...	2·7
6	0·5 3·5	... ...	... ...	... ...	... ...	0·4 3·0	... ...	1·6 4·0	9·4 2·8	18·2 3·7	25·3 4·1	23·8 4·4	5·4 3·2	9·0 4·5	4·4 3·1	1·1 4·0	0·9
7	0·5 3·0	0·5 2·9	2·4 3·0	0·2 2·0	1·3 4·0	0·9 4·2	1·0 2·7	0·1 2·0	5·4 4·2	10·7 4·0	38·4 4·8	23·2 5·3	10·2 5·0	1·2 4·6	0·5 2·0	0·9 2·5	2·6
8	3·8 2·0	... ...	... ...	... ...	... ...	1·3 4·0	1·3 4·0	16·0 3·8	1·9 3·0	0·6 6·0	36·2 4·6	16·7 4·8	1·7 3·5	... ...	11·8 3·3	... ...	8·7
9	5·7 1·0	0·3 1·0	1·6 1·0	... ...	2·1 1·0	... ...	... ...	... ...	5·2 2·0	2·9 4·1	45·1 3·5	18·6 3·1	6·7 2·2	0·2 2·0	3·5 5·0	... ...	8·1
10	0·6 3·0	... ...	... ...	... ...	... ...	... ...	0·5 6·0	6·1 3·4	2·9 3·9	13·2 3·7	37·7 4·2	18·1 3·8	12·3 3·6	4·5 4·1	0·9 4·0	... ...	3·2
11	0·3 2·0	... ...	0·2 2·0	... ...	0·2 2·0	... ...	... ...	4·4 4·1	8·8 3·5	12·9 4·3	30·4 4·4	27·8 5·3	12·2 5·2	2·2 5·0	0·6 3·5	... ...	...
12	0·2 1·0	0·3 2·0	... ...	... ...	... ...	0·5 1·5	1·4 2·5	2·7 3·6	4·5 3·4	9·2 4·3	44·5 5·0	27·0 4·9	5·8 4·5	1·7 4·8	1·8 3·3	0·2 2·0	0·2
13	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	50·5 5·0	39·9 5·5	3·1 4·3	1·3 4·0	2·6 3·0	... ...	2·6
14	... ...	... ...	... ...	... ...	... ...	... ...	0·8 2·0	... ...	3·5 3·0	4·8 5·0	43·4 4·8	29·7 5·1	6·7 2·9	3·7 2·5	... ...	... ...	7·4
15	0·6 2·3	0·4 1·5	0·6 2·5	0·7 2·5	1·8 1·8	0·9 2·3	2·7 1·7	3·1 2·6	5·7 3·0	12·8 3·7	24·5 4·2	15·5 4·2	13·5 3·4	0·9 2·8	3·7 1·9	1·3 2·4	11·3
16	... ...	... ...	... ...	... ...	0·2 3·0	... ...	1·1 1·8	1·6 2·5	8·0 4·3	31·1 4·3	33·7 4·7	20·7 5·1	3·6 5·4	... ...	... ...	... ...	...
17	0·3 5·0	... ...	... ...	... ...	... ...	... ...	0·6 1·0	0·4 3·5	7·6 4·1	14·3 4·5	49·5 4·9	19·2 5·3	6·5 4·8	0·8 4·3	0·3 1·0	... ...	0·5
18	0·6 1·0	... ...	0·5 2·0	... ...	0·4 2·5	0·1 4·0	0·9 1·3	0·2 2·0	2·1 3·0	20·1 4·1	44·3 4·5	21·3 4·2	4·3 3·8	0·9 3·5	0·4 5·0	... ...	3·9
19	... ...	3·2 2·5	2·7 1·7	... ...	3·1 3·0	... ...	... ...	... ...	2·1 6·0	1·3 5·5	6·1 7·1	35·2 5·8	38·6 5·5	4·3 5·3	0·8 4·0	... ...	2·6
20	... ...	... ...	... ...	... ...	... ...	... ...	2·6 2·1	2·0 2·0	5·7 3·2	7·7 4·6	24·5 4·3	31·3 5·5	17·5 5·6	5·5 5·7	... ...	... ...	3·2
21	... ...	... ...	... ...	0·5 4·0	0·1 1·0	... ...	0·1 3·0	4·6 3·4	10·5 3·7	13·7 3·9	26·1 4·2	29·7 4·9	13·0 5·1	0·5 6·0	... ...	... ...	1·2
22	0·2 1·0	0·6 2·0	... ...	... ...	0·8 1·3	0·1 3·0	1·0 1·2	1·3 3·3	7·6 3·4	15·9 3·1	36·8 3·9	22·9 3·6	6·2 3·2	0·8 2·9	0·4 2·5	0·1 2·0	5·3
23	2·8 2·5	3·1 2·3	1·1 2·5	0·4 2·0	2·3 2·0	0·8 2·0	4·3 2·0	... ...	6·2 3·0	0·8 4·0	6·9 3·2	7·7 4·8	18·2 3·3	18·5 3·4	8·5 2·1	0·7 4·0	17·7
24	... ...	... ...	... ...	... ...	[illegible]·9 3·0	1·3 3·5	10·3 3·4	9·2 3·3	6·2 2·8	7·9 3·9	15·1 4·7	23·0 4·9	15·7 4·8	7·1 5·2	2·6 5·0	0·4 6·0	0·3
25	... ...	... ...	... ...	0·2 1·0	... ...	0·3 4·0	2·8 2·7	4·1 3·4	9·4 3·1	13·8 3·7	21·7 3·6	25·0 4·7	18·4 5·2	2·3 4·1	0·1 2·0	... ...	1·9
26	0·3 1·5	0·1 2·0	0·4 3·0	... ...	0·9 1·3	0·3 3·0	2·2 2·6	4·4 2·2	7·8 2·2	11·2 3·2	23·7 3·2	23·1 3·8	15·9 3·0	1·4 3·5	1·0 3·3	0·8 2·0	6·5

BAY OF BENGAL

MEAN PRESSURE, WIND AND CURRENT CHART
FOR THE MONTH OF

SEPTEMBER

N.B. WINDS BLOW TOWARDS THE CENTRE OF THE WIND ROSE



Compiled by W.L. Dallas.

PUBLISHED BY THE METEOROLOGICAL DEPARTMENT OF THE GOVT OF INDIA.

PHOTOZINCOGRAPHED AT THE SURVEY OF INDIA OFFICES, CALCUTTA, JUNE 1886.

METEOROLOGY OF THE BAY OF BENGAL.

OCTOBER.

IN October the barometer is higher than in September over the north and centre of the Bay, but slightly lower in the extreme south. Readings are now very uniform throughout the whole region included in the chart, but continue somewhat higher in the south than in the north. There are two independent areas of relatively low pressure, one extending from the head of the Bay along its western side as far south as Ceylon, the second over the Andaman and Nicobar Islands and the adjacent parts of the Bay. This distribution is, in some respects, the opposite of that which existed in March, when the highest readings were over the centre of the Bay. Within these areas of low pressure, the barometric means vary between 29·82 inches and 29·85 inches, the seat of lowest average barometer being, in the one case, between the Andamans and Nicobars, in the other to the east of Pondicherry at a distance of about 80 miles from the coast. These are essentially the cyclonic regions of the Bay of Bengal at this season.

Winds.—The winds are very variable in most parts of the Bay. But those from northerly and easterly quarters preponderate in the north and north-west, and those from south and west in the central region, the east, and especially the south of the Bay.

The former prevail in districts Nos. 1, 2, and 3, the latter over the southern portion of the area and in districts Nos. 8, 9, 11, 12, and 13. Between these two, in the tract illustrated by wind-roses Nos. 4, 5, 7, and 10, the two currents are about equally balanced. In the Straits of Malacca there is a preponderance of westerly winds.

Calms.—As might be anticipated from the preceding considerations, calms are very frequent in this month, the highest percentages being in districts Nos. 1, 9, and 17. Summing up the data of all the wind-roses, the following results are obtained. The figures for September are added for comparison :—

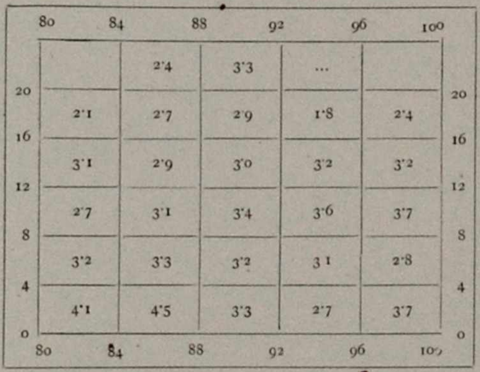
	N	NE	E	SE	S	SW	W	NW	Calms, &c.
September . . .	2	1	1	4	15	46	22	4	5
October . . .	4	7	9	7	10	25	24	6	8

Force.—As regards force, there has been a further decrease, the average for the whole Bay being barely 3·0 as against 3·5 in September. The S.W. winds, though restricted in range, have greater average strength than north-east winds. Thus, in the divisions adopted above, the following results are obtained :—

District of predominant N.E. winds the mean force is	2·1
" " variable	2·8
" " S.W.	3·0

On the average of the whole Bay, the direction corresponding to the highest mean force is S.W. to W. S.W., and that with the lowest is north. The region within which the winds from all directions have the greatest force is illustrated by wind-rose No. 19; and that with the least, by wind-rose No. 21.

The following diagram gives the average force of the wind for each 4° square, irrespective of direction. The vertical strip in which the force is greatest is that between Longitudes 84° and 88°, and the transverse strip that between Latitudes 0° and 4.°



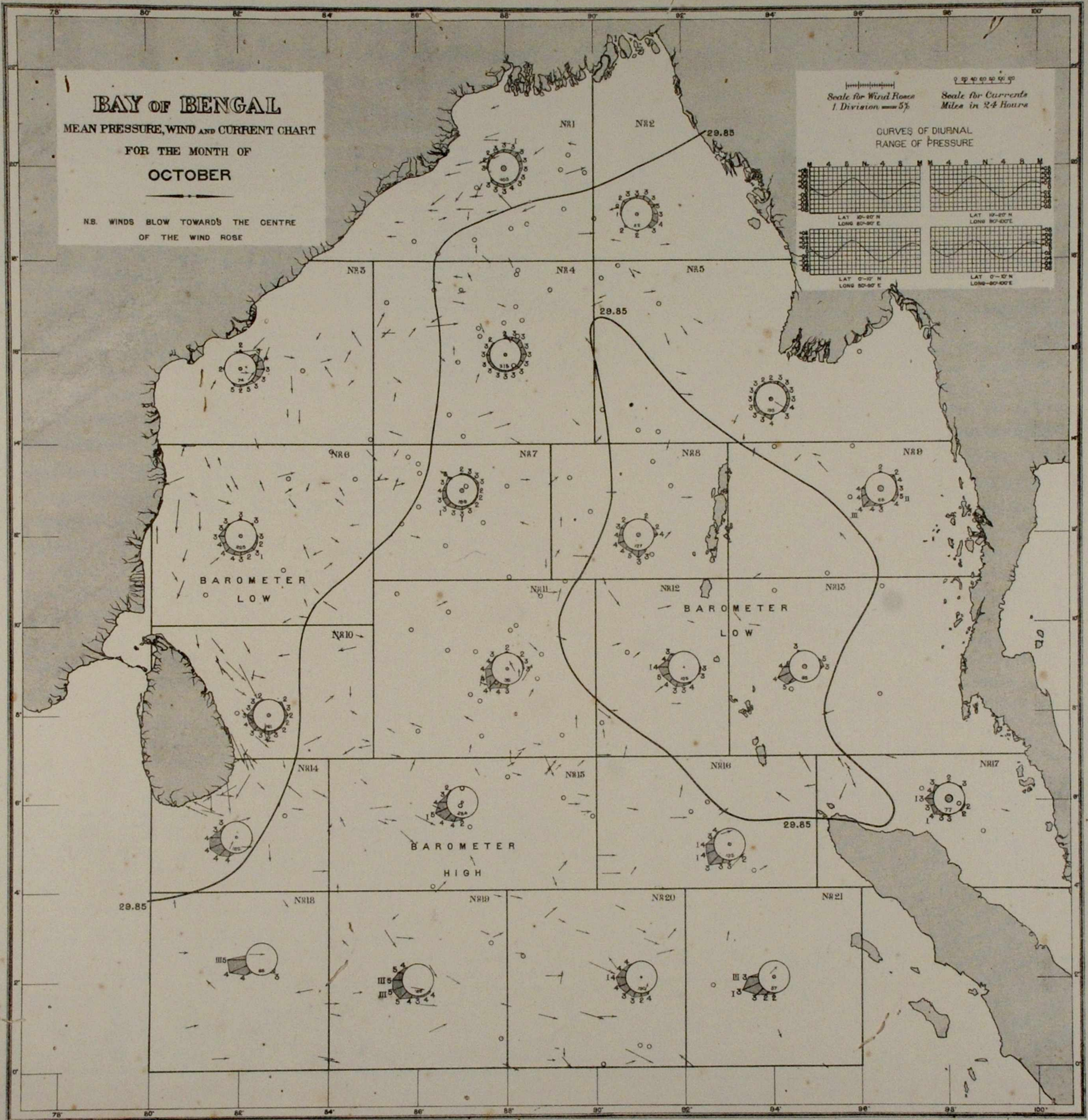
Gales.—The month of October is notorious for the severity of its cyclonic storms in the Bay of Bengal, but the year often passes without one; and the frequency of gales, in proportion to the total number of observations, does not greatly exceed that of some other months. In the equatorial sea to the south of the Bay, winds exceeding force 8 of the Beaufort scale are very frequent, and in the Andamans Sea, between the Andamans and the Tenasserim coast, the weather is squally and stormy. In the Straits of Malacca the percentage of gales is less than in September, but conditions continue unsettled and squally.

The following is a List of the gales recorded in the month of October :—

1737 October	7th.	—A violent earthquake and furious hurricane occurred at the mouth of the Ganges.
1747 "	2nd.	—Hurricane in Madras Roads ; storm not felt at Pondicherry.
1752 "	31st.	—Violent Hurricane Madras coast ; rain fell continuously for several days.
1763 "	21st.	—Severe gale at Madras ; all vessels in roads lost.
1768 "	29th.	—Severe gale at Madras ; local, not felt at Pondicherry.
1782 "	20th.	—Gale at Madras.
1792 "	26th—27th.	—Gale at Madras.
1800 "	19th.	—Furious hurricane at Ongole and Masulipatam.
1800 October	28th.	—Hurricane at Coringa and Masulipatam.
1818 "	23rd—24th	—Cyclone at Madras ; centre passed over Town.
1831 "	31st.	—Cyclone at Balasore and Cuttack.
1836 "	30th.	—Cyclone at Madras ; centre passed over Town.
1838 "	19th.	—Gale at Kejiri at the Hugli estuary.
1842 "	2nd—5th.	—Cyclone passed across north of Bay in N. W. direction, striking coast near Cuttack.
1842 "	22nd.	—Cyclone started from Andamans passing westward to Pondicherry.
1848 "	12th—14th.	—Cyclone generated over head of Bay ; travelled north-westward to False Point.
1851 "	20th—23rd.	—Cyclone formed over head of Bay ; passed over False Point Light House.
1854 "	6th.	—Hurricane to south of Ceylon.
1864 "	2nd—5th.	—Tremendous cyclone travelled from N. W. of Andamans to Bengal.
1864 "	25th.	—Cyclone in north of Bay ; passed over Vizagapatam.
1867 "	27th.	—Cyclone travelled from Nicobars to Bengal, passing over Port Canning.
1869 "	7th—8th.	—Storm travelled from N. E. of Bay to mouth of the Hugli.
1872 "	24th—26th.	—Cyclone in Andaman Sea ; passed over Narcondam Island.
1874 "	13th—16th.	—Cyclone of extraordinary violence originated latitude 16°, longitude 89°, passed north-westward to mouth of the Hugli.
1874 "	24th—26th.	—Cyclone at Coconada.
1876 "	5th.	—Severe cyclone formed to W. of Andamans ; travelled W. N. W. to Vizagapatam.
1876 "	29th.	—Severe cyclone formed near Andamans ; travelled N. to mouth of the Megna.
1878 "	13th—16th.	—Small storm generated on coast of N. Circars ; crossed Coast between Masulipatam and Vizagapatam.
1878 "	28th—31st.	—Storm began in centre of Bay ; travelled N. W. to Masulipatam.
1879 "	10th—15th.	—Slight storm formed off Arakan coast ; travelled W. N. W. to Balasore.
1879 "	25th—27th.	—Formed off Arakan coast ; crossed coast near Chittagong.
1880 "	12th—15th.	—Generated over centre of Bay ; travelled W. to Vizagapatam.
1881 "	2nd—9th.	—Developed in centre of Bay ; advanced N. W. to coast of Circars.

Currents.—The currents of the Bay are not very dissimilar from those of September. Over the head of the Bay and on the coast of Orissa and the northern Circars, the currents are more westerly than in the preceding month ; but on the Coromandel coast, they are steadily southerly, and on the east coast of Ceylon, strongly south-south-easterly, parallel to the coast. On the south coast, there is a slight set to the westward. In the southern portion of the Chart, below latitude 7°, the observations show a pretty general easterly current, but over the Bay proper, with the exception of the long-shore current, noticed above, the currents are a good deal confused and, in the centre, *i.e.*, between Longitudes 85° and 90° and Latitudes 7° and 14°, the observations show very little motion. The main sets are then :—A westerly current in the N. E. of the Bay ; a southerly current along the Coromandel coast ; a south-south-east current off the east of Ceylon and a general easterly current over the seas in the south.

No. of Wind-Rose.	Percentages.																
	N.	NNE.	NE.	ENE.	E.	ESE.	SE.	SSE.	S.	SSW.	SW.	WSW.	W.	WNW.	NW.	NNW.	Calms, &c.
1	6·2 2·6	8·0 3·0	11·4 3·2	8·3 3·0	5·9 3·0	2·6 3·1	3·8 3·0	4·3 3·7	6·0 2·9	5·7 3·4	6·2 3·3	2·0 2·3	4·6 3·0	3·6 2·3	5·8 2·2	3·3 2·5	12·3
2	4·0 2·5	9·3 2·6	8·0 3·4	6·9 3·4	11·2 2·9	13·9 3·7	9·0 3·0	1·5 2·0	3·7 2·0	1·0 3·0	4·8 2·3	1·4 2·0	2·6 1·0	4·3 2·0	7·3 2·3	4·0 2·5	7·1
3	6·1 2·2	0·5 2·5	11·2 2·5	16·6 3·6	17·5 3·4	11·8 2·8	6·4 2·8	2·5 4·8	4·7 2·4	4·7 4·6	1·3 2·5	2·0 3·0	2·7 2·0	... ...	2·0 2·0	1·7 2·0	8·3
4	3·6 2·4	6·1 3·1	11·2 2·7	8·2 2·9	12·4 2·9	7·8 2·7	6·1 2·7	3·4 2·8	3·9 2·6	4·0 2·9	5·5 3·1	6·9 3·0	7·1 3·2	4·1 2·7	2·8 2·1	0·8 2·6	6·1
5	3·1 2·4	5·4 3·2	6·6 2·9	6·0 2·9	7·3 3·4	6·6 3·8	7·6 2·6	2·4 3·3	11·0 3·5	5·3 3·1	8·8 3·2	6·1 3·2	4·0 2·6	4·7 3·0	4·2 3·0	2·9 2·2	8·0
6	5·1 2·8	1·7 2·4	4·7 2·8	1·9 2·9	4·1 3·4	5·4 2·4	6·3 2·7	4·0 2·2	7·7 3·1	8·9 3·5	11·4 3·9	8·2 3·6	13·7 3·4	3·9 2·8	3·6 2·6	1·6 3·1	7·8
7	3·6 2·0	2·8 2·8	2·5 3·1	6·0 3·3	2·7 2·4	3·6 1·8	4·3 1·8	4·4 2·9	9·6 3·0	7·6 2·7	11·6 3·2	11·3 3·0	8·3 3·6	2·8 2·9	7·3 2·6	2·2 2·8	9·4
8	1·0 1·5	2·8 1·5	2·4 2·1	2·5 2·4	9·9 4·1	2·1 3·5	1·9 3·2	5·7 2·8	15·3 3·2	5·5 4·9	8·5 3·5	14·1 3·8	8·7 3·8	6·6 2·9	3·0 2·1	0·9 2·3	9·1
9	3·1 1·9	2·3 1·9	6·0 2·2	2·9 3·5	2·9 3·3	7·2 5·3	6·0 3·8	0·5 2·0	4·2 3·2	5·5 4·1	21·9 4·4	11·7 4·2	9·4 3·7	0·2 2·0	1·4 1·3	1·3 1·5	13·5
10	2·1 3·1	0·8 2·0	5·5 2·2	4·0 2·6	9·4 2·4	2·6 2·3	4·6 2·2	4·2 2·5	10·0 2·4	3·4 2·0	10·4 3·3	11·1 3·5	12·5 3·3	3·8 3·3	4·4 2·5	2·6 2·3	8·6
11	3·5 2·0	0·2 1·7	2·6 2·0	3·1 3·4	2·9 3·1	1·2 2·4	1·7 2·0	1·8 2·0	5·1 2·7	10·2 3·5	24·7 4·3	15·6 3·8	13·4 3·6	3·2 3·6	2·6 2·7	1·4 3·0	6·8
12	0·7 3·0	1·5 2·3	0·7 3·0	2·0 1·8	3·2 2·5	3·3 3·0	1·9 4·7	3·9 3·6	6·5 3·1	12·0 3·3	10·9 3·9	15·9 5·0	22·4 4·3	5·8 3·5	6·1 3·4	1·2 4·5	2·0
13	2·3 3·3	2·2 3·4	1·8 2·7	3·8 4·7	8·2 3·3	1·5 3·0	0·8 2·5	... ...	1·3 3·0	0·8 4·0	20·1 4·5	29·4 4·0	11·4 4·2	... ...	1·7 3·5	4·5 3·3	10·2
14	0·8 2·8	0·3 1·0	0·3 3·0	0·1 2·0	... ...	0·3 5·0	1·0 3·8	0·3 3·0	1·2 1·7	10·4 3·7	19·8 3·7	26·9 4·0	23·9 3·7	5·5 2·9	2·6 2·8	1·4 3·3	5·2
15	0·8 1·8	... ...	0·2 2·0	1·1 2·0	1·0 2·4	0·6 1·8	0·3 2·5	1·4 2·5	4·6 2·2	11·6 4·1	19·9 4·2	27·4 4·5	16·8 3·9	4·4 3·0	3·5 2·4	1·2 2·6	5·2
16	0·2 2·0	... ...	... ...	1·4 1·7	0·9 1·7	0·7 1·0	3·1 1·9	1·0 2·0	5·7 3·2	9·7 2·9	26·9 3·0	20·2 3·9	17·3 3·8	2·9 3·1	2·7 3·9	1·2 2·0	6·1
17	2·6 1·7	2·2 4·0	3·4 2·5	2·0 2·8	2·4 2·4	3·7 1·8	4·3 2·0	1·5 1·3	3·3 3·0	3·9 2·7	12·7 3·7	8·0 3·2	19·6 3·3	3·6 4·1	8·2 3·0	2·3 3·0	16·3
18	... ...	... ...	... ...	... ...	... ...	... ...	7·4 3·4	... ...	1·8 1·5	2·2 2·5	12·9 3·7	37·5 4·4	36·8 4·7	1·4 4·0	... ...	... ...	......
19	... ...	... ...	... ...	... ...	... ...	0·5 2·0	3·8 4·1	3·5 4·4	3·3 2·8	7·8 3·8	21·3 4·7	24·7 5·0	20·7 4·6	10·4 5·2	3·3 4·4	... ...	0·7
20	0·9 2·2	0·1 1·0	0·4 1·7	0·2 1·0	1·8 1·9	.. ...	2·0 2·9	5·2 3·5	7·3 2·2	11·0 3·2	12·1 3·3	18·0 4·0	20·1 4·2	10·3 3·7	4·8 3·6	0·7 2·0	5·1
21	1·3 2·0	... ...	0·5 3·0	... ...	... ...	... ...	0·5 1·0	0·4 2·0	3·2 2·0	5·7 1·8	19·4 2·9	38·8 3·2	20·7 3·1	1·5 2·0	0·6 2·0	0·4 1·0	7·0



BAY OF BENGAL

MEAN PRESSURE, WIND AND CURRENT CHART

FOR THE MONTH OF

OCTOBER

N.B. WINDS BLOW TOWARDS THE CENTRE OF THE WIND ROSE

Compiled by W. L. Dallas.

PUBLISHED BY THE METEOROLOGICAL DEPARTMENT OF THE GOVT. OF INDIA.

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METEOROLOGY OF THE BAY OF BENGAL.

NOVEMBER.

THE reversal of the barometric gradient, which began in the month of September, is complete in the month of November, when the seat of highest barometer is established in the north of the Bay, and that of low barometer in the south, in the neighbourhood of the Equator. This is due to a barometric rise of about 0·12 inch in the north of the Bay; of 0·10 inch in the Gulf of Martaban and of about 0·05 inch over the centre of the Bay, while pressure has remained unaltered or fallen slightly in the south. The lowest mean barometer (29·866 inches) is now in the Straits of Malacca, and there is a difference of 0·1 inch between that region and the north of the Bay. Over the whole southern portion of the chart, pressure is very uniform.

Winds.—In November, as in October, south-west and north-east are the prevailing winds, but a considerable change has taken place in their relative prevalence. In October, the belt of their equal frequency traversed the Bay in a north-east direction from Ceylon to the Arakan Coast. This belt has now moved southward—particularly on the eastern side—and extends almost due east and west between Ceylon and the Straits of Malacca. Within this belt, the winds are very variable; directions between south-south-west and south-south-east being rare. Further south, that is between the Equator and lat. 4°, west and south-west winds predominate; less to the south of Ceylon than further eastward. Over the Bay, to the north of the belt of variable winds, the winter or north-east monsoon is well established. In Districts Nos. 9 and 13, to the west and south-west of the Andamans, winds from between west and south-west are rather more frequent than elsewhere; and in the region illustrated by No. 12, the variability approximates to that of 4° or 5° further south. At the head of the Bay (Nos. 1 and 2), the winds are more northerly than in the more central Districts.

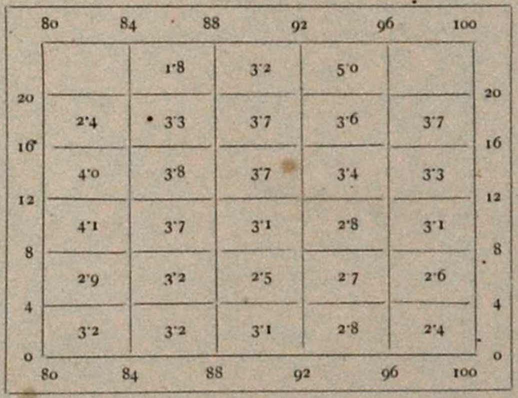
Calms.—Calms are less frequent than in October. They are most common in the southern Districts of the Bay and again in the extreme north, and least frequent where the north-east monsoon prevails and in the Equatoreal Seas to the south. The seat of their greatest frequency is in the neighbourhood of Ceylon. Summing up the data of all the wind-roses, the following results are obtained. The figures for October are added for comparison:—

	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calms, &c.
October	4	7	9	7	10	25	24	6	8
November	14	28	14	6	4	8	11	9	6

This comparison shows in an emphatic manner the change in the aerial circulation of the Bay. The number of north-easterly winds has quadrupled, and north, east, and north-west winds have all undergone a striking increase at the expense of those from south, south-west, and west.

Force.—As compared with October, there has been a slight increase in the general strength of the wind, but the change is not great. The mean force of the wind in the Districts south of the Bay, is now less than 3·0 and that of all the winds recorded to the northward of lat. 8° is 3·4; showing that the north-east current preponderates in average strength, as well, as in the extent of its prevalence. In the variable belt between lats. 4° and 8°, the mean force of all the winds is 2·7 only. On the average of the whole Bay, the wind with the highest mean force is east-north-east.

The following diagram gives the average force of the wind for each 4° square, irrespective of direction. The vertical strip in which the force is greatest is that between longs. 84° and 88° and the transverse strip that between lats. 12° and 16°:—



	80–84	84–88	88–92	92–96	96–100
		1·8	3·2	5·0	
20–16	2·4	3·3	3·7	3·6	3·7
16–12	4·0	3·8	3·7	3·4	3·3
12–8	4·1	3·7	3·1	2·8	3·1
8–4	2·9	3·2	2·5	2·7	2·6
4–0	3·2	3·2	3·1	2·8	2·4

Gales.—Storms, though less frequent than in October, are by no means rare in the month of November. They are apparently restricted to two regions in the Bay. The first includes the Andaman Sea and extends northward along the Arakan Coast as far as Akyab; the second is the Sea lying immediately off the Coromandel Coast, and extending from Vizagapatam as far south as Negapatam. Within these two regions, storms are not infrequent. In the former the gales blow from north-east, changing through east to south-east, while in the latter they more generally begin from north-west and veer through north to north-east or east; occasionally, in the case of very severe storms, shifting as far as south-east and south. In the Equatoreal Sea to the southward, gales occur, but much less frequently than in October.

The following is a list of the recorded gales of the month of November:—

1797—	November	?	Gale in the north of the Bay.
1839—	"	12th—17th.	—Cyclone passed across Bay from the Andamans to Coringa.
1840—	"	21st.	—Gale to the north-east of the Andamans.
1843—	"	28th.	—Cyclone travelled from lat. 6° and long. 90° in a north-westerly direction, but did not reach land.
1844—	November	9th—14th.	—Cyclone to the east of the Andamans.
1845—	"	29th—December, 2nd.	—Cyclone passed from the south of the Bay westward to Ceylon, centre passing near Batticaloe.
1850—	"	17th—19th.	—Cyclone formed in the Andaman Sea; east of Port Blair; travelled north-north-west.
1856—	"	17th—21st.	—Cyclone over centre of Bay; also felt at Madras.
1857—	"	2nd.	—Gale off Ceylon; cen[illegible] passed over Nellore.
1864—	"	5th.	—Cyclone at Masulipatam.
1867—	November	12th.	—Cyclone in north-east of the Bay.
1868—	"	?	—Cyclone at Akyab.
1870—	"	5th.	—Cyclone formed over centre of Bay; passed to Vizagapatam where wind blew a hurricane.
1873—	"	3rd.	—Severe cyclone, lat. 15° 30′, long. 85° 0′.
1874—	"	1st.	—Cyclone at Coconada apparently advanced from east.
1874—	"	10th—12th.	—Cyclone originated about lat. 19°, long. 84°, travelled northward; broke up between Pooree and False Point.
1877—	"	2nd—5th.	—Small storm generated over centre of Bay; travelled north-east to Arakan.
1878—	"	3rd—6th.	—Storm generated in centre of Bay near Andamans; travelled to Masulipatam.
1879—	"	1st—5th.	—Cyclone formed over Gulf of Martaban; travelled north-north-west to Rangoon Coast.
1879—	"	15th—20th.	—Small storm generated to south-west of Andamans; advancing west-north-west to Coromandel Coast.
1880—	"	19th—22nd.	—Formed in south of Bay; struck coast near Negapatam.
1881—	"	10th—13th.	—Developed in south-west of Bay; advanced north-west to Madras Coast.
1883—	"	8th—15th.	—Small cyclone formed in neighbourhood of Andamans, and passed northward to Akyab.

Currents.—A westerly current sets sometimes across the head of the Bay and is also experienced along the Orissa and Ganjam Coast, as well as to a considerable distance out to sea. To the south of lat. 16°, on this side of the Bay, the set becomes southerly and off Madras runs very strongly to due south. Throughout the season of the north-east monsoon, the current is southerly on this coast, but it reaches its maximum strength in November, when it sometimes has a velocity of nearly 4 miles per hour. A strong southerly current also sets along the east coast of Ceylon and continues past the Basses; but to the westward of these rocks the current changes its direction with the coast line and flows as a westerly current round the south of Ceylon. Some little distance to the eastward of Ceylon, between 84° and 86° Long., the set of the water is often northerly, and in the latitude of Madras in the same meridian, it is generally westerly. Off Acheen Head, and indeed over a large part of the eastern half of the Bay, the general current is to west or north.

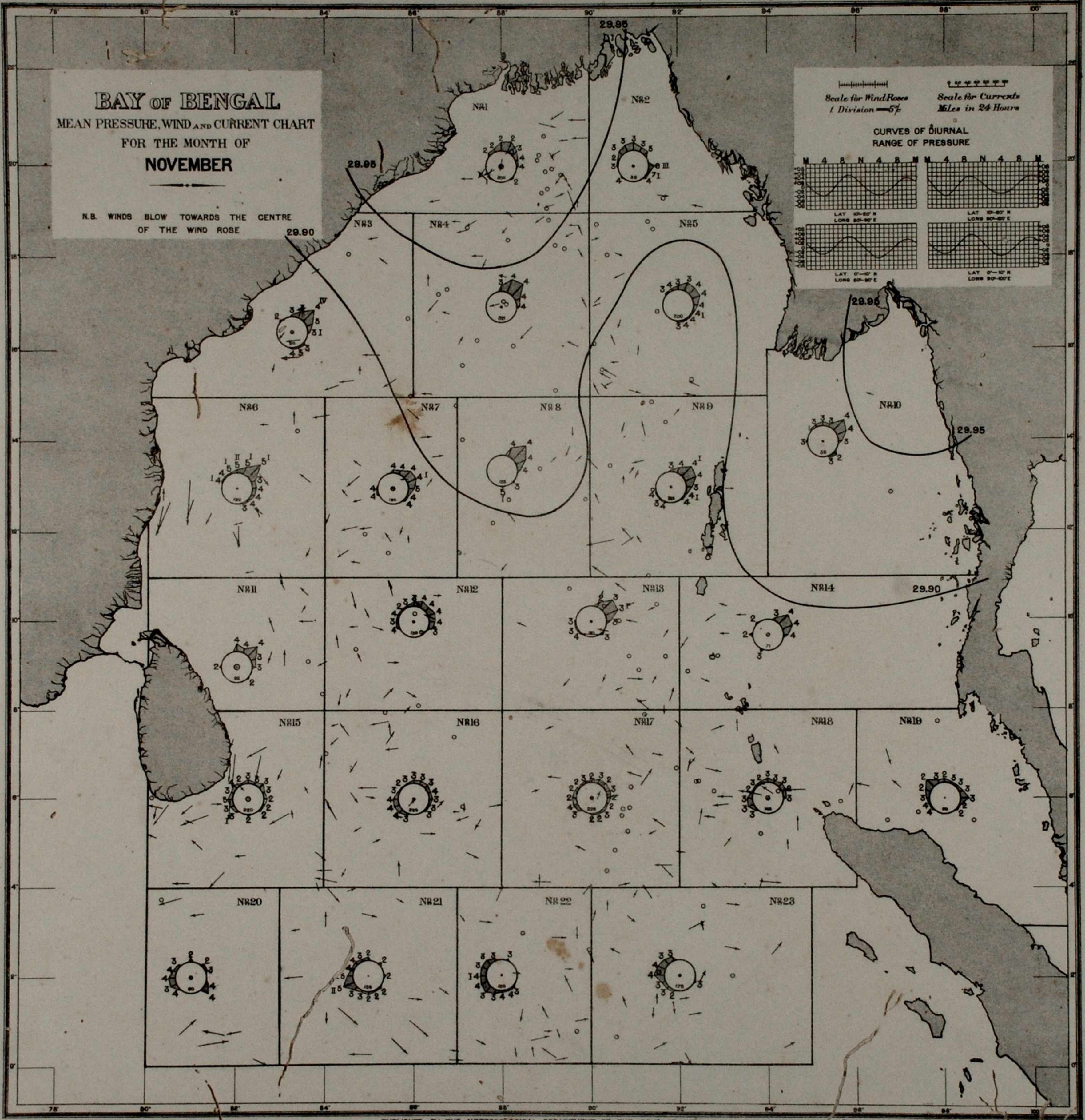
No. of Wind-rose.	Percentages.																
	N.	NNE.	NE.	ENE.	E.	ESE.	SE.	SSE.	S	SSW.	SW.	WSW.	W.	WNW.	NW.	NNW.	Calms, &c.
1	18·0 2·3	22·3 2·4	13·1 3·1	5·1 3·7	3·4 3·9	2·0 4·2	2·7 1·6	0·1 1·0	1·0 2·6	0·8 1·7	3·2 1·4	1·0 1·4	2·2 1·2	2·2 1·8	6·5 2·0	6·0 2·2	10·4
2	16·6 2·8	9·4 3·2	9·5 4·5	1·0 7·7	11·2 6·3	4·1 6·7	3·6 3·5	0·6 5·0	... ...	0·6 5·0	2·6 4·0	1·1 2·0	3·6 2·8	4·3 2·2	11·6 3·4	14·3 3·2	5·9
3	4·3 3·4	13·6 3·4	30·9 3·7	14·6 4·6	4·6 3·4	1·4 3·0	3·7 2·5	4·4 4·5	3·7 3·9	1·8 6·3	0·6 2·0	1·7 4·3	1·9 7·5	2·1 4·5	2·7 2·3	1·0 4·8	7·0
4	10·9 2·9	28·4 3·5	32·3 3·6	10·1 3·9	6·3 3·8	1·3 3·6	2·3 5·0	1·2 3·8	0·9 2·6	1·1 3·5	0·7 1·3	0·1 2·0	0·5 2·0	0·2 2·0	0·6 1·4	0·4 2·0	2·7
5	8·1 3·3	18·5 3·2	16·0 3·6	16·7 4·1	9·2 4·2	3·5 4·4	3·1 4·3	2·9 4·2	3·6 3·3	1·6 3·0	1·4 1·7	1·7 5·4	1·5 4·1	2·4 3·6	4·2 3·3	4·7 3·5	0·9
6	6·0 4·6	14·6 4·8	35·6 4·7	7·8 3·3	7·9 4·2	6·5 4·3	3·5 4·4	2·6 3·4	1·3 8·5	... ...	0·2 5·0	0·4 5·0	1·3 3·5	3·1 4·1	3·4 4·1	2·5 5·3	3·3
7	5·6 3·9	7·5 3·7	19·0 3·6	20·3 4·3	11·6 4·7	3·4 4·0	4·5 3·7	2·3 2·7	2·2 3·6	1·1 4·8	1·0 4·0	4·6 3·7	2·6 3·5	1·1 5·5	1·0 2·7	2·2 3·3	10·0
8	2·3 4·6	19.0 3·6	38·7 3·8	22·8 3·8	5·3 4·0	1·8 2·0	2·7 2·8	1·1 5·0	2·5 5·0	1·1 8·4	... ...	... ...	... ...	... ...	0·7 2·7	0·2 3·0	1·8
9	3·1 2·9	11·8 3·6	26·9 4·1	24·0 3·9	11·2 3·1	2·8 4·0	2·5 4·1	0·1 1·0	0·9 3·0	2·9 3·9	2·9 3·4	2·7 4·2	1·5 4·7	0·5 5·0	1·7 2·2	1·4 2·4	3·1
10	7·4 2·6	5·7 2·8	29·4 4·3	20·1 4·3	7·0 3·4	0·4 2·0	7·2 2·6	4·1 2·5	1·2 3·0	1·0 3·5	0·5 2·0	0·6 3·0	3·0 2·8	0·6 2·0	3·3 1·3	4·5 2·5	4·0
11	15·7 3·7	8·0 3·9	26·7 4·4	10·1 3·4	7·4 3·0	2·1 3·3	2·5 2·4	0·5 5·0	2·2 1·5	1·4 1·5	1·6 7·5	1·8 2·3	3·6 2·4	1·1 4·0	0·6 2·0	0·9 7·0	13·8
12	7·8 3·1	13·4 3·5	9·5 3·6	14·0 4·4	12·1 4·4	7·7 3·4	1·6 3·4	1·6 5·5	1·6 3·7	0·8 5·8	2·4 2·5	5·3 3·6	4·8 3·2	4·1 3·8	3·0 2·3	3·5 3·0	6·8
13	2·1 2·4	10·3 2·9	29·3 3·3	26·6 3·3	6·6 3·3	2·2 3·8	2·9 2·6	1·0 2·8	1·6 1·8	1·4 2·5	2·7 4·1	3·5 3·1	2·7 2·9	1·3 2·0	1·0 1·3	0·1 1·0	4·7
14	2·1 2·5	5·0 3·3	25·3 3·6	22·3 3·7	9·1 3·9	0·4 3·0	0·2 3·0	1·9 1·0	1·0 1·5	7·3 2·7	1·2 1·5	1·5 2·0	7·5 1·8	1·7 2·3	2·8 1·7	2·1 1·5	8·6
15	7·4 2·7	2·9 2·7	11·9 2·7	4·1 3·1	6·0 2·0	3·4 1·8	3·1 1·9	1·6 2·0	2·6 1·9	1·9 2·7	5·1 3·1	8·8 3·4	10·3 4·5	5·3 3·2	9·3 3·9	3·4 2·0	12·9
16	7·1 3·2	8·0 2·8	9·4 3·2	5·2 3·8	7·0 2·6	4·3 2·9	3·9 3·0	1·7 3·2	2·3 2·6	4·0 3·2	9·4 3·7	11·5 3·8	10·3 4·3	4·2 3·3	2·5 2·4	2·8 2·9	6·4
17	2·8 1·9	9·0 2·8	9·0 2·4	8·8 3·2	6·5 2·3	3·0 2·0	5·1 2·6	3·8 2·2	2·6 1·8	1·2 1·9	6·9 2·8	9·5 3·9	9·1 2·4	5·5 2·2	3·9 2·2	4·0 2·6	9·3
18	8·4 3·0	4·8 2·7	9·8 2·8	7·9 2·4	5·4 2·9	2·2 2·2	2·1 2·6	2·4 2·4	2·4 2·4	2·3 2·6	4·7 3·3	12·7 3·3	11·0 2·9	4·8 1·9	4·6 2·8	4·9 2·3	9·6
19	7·1 2·1	4·2 2·8	4·3 3·3	7·4 3·2	16·6 2·5	2·8 2·0	3·9 1·8	... ...	0·5 3·0	... ...	3·0 3·9	3·3 3·5	6·2 2·8	11·4 2·3	20·8 2·3	6·5 2·6	2·0
20	7·8 2·2	2·3 2·5	5·2 2·0	3·1 3·3	2·2 3·5	5·5 4·0	15·7 3·7	2·4 4·3	0·4 2·0	1·0 1·5	3·0 3·7	14·0 3·4	14·4 4·1	6·2 3·8	5·6 3·3	1·5 2·3	9·7
21	6·6 2·1	2·1 2·1	5·9 2·1	1·3 2·3	2·5 2·0	2·3 2·9	3·7 2·3	2·5 2·3	5·3 2·2	3·2 2·5	8·4 3·4	24·5 5·1	12·0 4·8	5·8 3·9	7·2 3·7	4·0 3·1	2·7
22	0·7 4·0	3·9 3·0	0·1 1·0	0·6 1·0	0·1 1·0	1·5 3·3	3·5 3·3	2·6 3·7	3·2 3·5	7·4 3·3	15·1 3·2	14·4 4·3	12·5 3·6	13·4 3·2	12·2 2·9	3·5 2·9	5·3
23	2·4 1·8	1·7 2·1	1·8 1·8	2·2 1·8	0·9 2·4	3·1 [illegible]	1·3 2·5	0·3 2·0	1·8 2·5	3·8 2·3	6·8 2·8	7·9 2·8	21·8 3·8	16·3 3·7	13·4 3·0	8·0 2·7	6·5

BAY OF BENGAL

MEAN PRESSURE, WIND AND CURRENT CHART FOR THE MONTH OF

NOVEMBER

N.B. WINDS BLOW TOWARDS THE CENTRE OF THE WIND ROSE



Compiled by W. L. Dallas.

PUBLISHED BY THE METEOROLOGICAL DEPARTMENT OF THE GOVT. OF INDIA.

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METEOROLOGY OF THE BAY OF BENGAL.

DECEMBER.

THE barometer continues rising in November and December throughout nearly the whole of the Bay in such manner as to increase the difference of pressure between the north and south. The line 29·9 inches, which in November crossed the north of the Bay, now lies between Ceylon and Sumatra, curving northward in the neighbourhood of the Bay Islands. The seat of the lowest pressures lies to the west and north-west of Sumatra in about Long. 93°. In the extreme north and north-west of the Bay, the highest barometric mean is 30·030 inches; one-twentieth of an inch higher than in November. The distribution is that characteristic of the winter monsoon. The relative depression of the barometer indicated by the readings between Sumatra and the Nicobars, together with the evidence of occasional strong winds from south, south-east and west in the surrounding wind-roses, indicate this region as one of occasional cyclones. In the eastern side of the Bay, along the Tenasserim and Malay Coasts, pressure is very uniform.

Winds.—South-westerly winds practically disappear from the Bay proper in this month and are only met with as exceptional in the Equatoreal Sea to the south. In wind-roses Nos. 20 to 23, the most frequent winds are in all cases from some northerly or westerly direction. Throughout the chart the preponderating wind is northerly. At the head of the Bay and also on the Arakan Coast, chiefly north, with frequent variations to north-north-east and north-east; over the centre and south of the Bay, north-east; while in the neighbourhood of the Equator, the wind varies round the compass from east through north and west to south-west. An exception to the preponderating north-east current in the Bay is found in the neighbourhood of the Nicobars, where southerly and south-easterly winds are not infrequent. At times, they reach the force of a gale. At the head of the Bay, during this month, light airs and calms with smooth seas are frequent, but the southerly winds which form a noticeable feature in January, are almost unknown in December. On the Coromandel Coast, the wind is chiefly north-east, occasionally varying to north and east; and on the east coast of Ceylon, from the same quarter, but more variable.

Calms.—Calms are less frequent than in November. They are not infrequent at the head of the Bay, but are most common to the west of Sumatra. In the centre of the Bay, where the monsoon prevails uninterruptedly, the percentage of calms is very small. Summing up the data of all the wind-roses, the following results are obtained. The figures for November are added for comparison:—

	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calms, &c.
November	14	28	14	6	4	8	11	9	6
December	22	36	13	4	3	4	6	7	5

These figures show a further increase in the number of north and north-east winds and a decrease in those from all other directions.

Force.—The mean force of the winds of the whole Bay is slightly higher than in November. South winds are the weakest, north-north-east the strongest, but winds from directions from north-north-west through north to east differ but little in strength. On the average the wind is strongest over the centre of the Bay to the west and north-west of the Andamans, and weakest at the head of the Bay and in the Straits of Malacca.

The following diagram gives the mean force of the wind for each 4° square, irrespective of direction. The vertical strip in which the force is greatest is that between long. 80° and 84° and the transverse strip that between lat. 12° and 16°:—

	80	84	88	92	96
20		2·8	2·3	2·3	
16	4·4	2·8	3·1	3·1	4·0
12	4·1	4·1	4·0	3·2	3·5
8	4·0	3·7	3·8	3·1	2·6
4	3·0	3·5	3·2	3·0	2·7
0	2·7	2·8	2·8	3·0	

Gales.—In the north and centre of the Bay, gales are of exceptional occurrence in December, but in the neighbourhood of the Andamans and Nicobars, on the Coromandel and Ceylon Coasts and also in the Equatoreal Sea, winds of the strength of a gale are not infrequent. As a rule, the gales are from some northerly quarter, but in the Andaman Sea, they are from south-east.

The following is a list of the recorded storms of the month of December:—

1803	December	4th.	Violent hurricane between Trincomalee and Madras.
1807	„	10th & 11th.	Gale at Madras. Storm local, not felt to the north of Pulicat nor at Pondicherry.
1830	„	2nd.	A gale of the most violent description felt at Pondicherry and Cuddalore; at Madras slight gale felt in evening.
1831	„	6th.	Cyclone at Pondicherry and Cuddalore, lasting only a few hours, but fearfully destructive.
1849	„	10th.	Severe hurricane at Madras.
1850	„	4th.	Hurricane at Madras.
1874	„	10th—12th	Storm, in south of the Bay.
1878	„	4th—9th.	Generated in the centre of the Bay, to west of the Andamans, travelled north-westward, crossed coast near Vizagapatam.
1882	„	4th & 5th.	Storm with very slight barometric disturbance generated over the Bay and passed apparently on a north-east course across Bengal.

Currents.—There is a general set to south-west throughout the more northern Districts of the Bay. The current commences on the Arakan Coast and crosses the Bay to the coasts of Orissa and the Northern Circars. On the Coromandel Coast, it turns south, but runs with less velocity than in November. To the east of Pt. Calimere, between the Meridians of 82° and 84°, it apparently sets to west or south-west; but round Ceylon within 50 miles of the coast, as in November, it sets along the coast running to south-south-east and south, then rounding the island to south-west and west. This current is stronger than in November and at times runs at a rate of between 2 and 3 miles an hour. To the south of Ceylon, the westerly current extends almost down to the Equator. Further eastward, the movement of the water in the extreme south of our area is less regular. In the Andaman Sea, the currents are chiefly to north-west, but west of the Bay Islands, the set changes to west across the Bay, coalescing with the southerly movement on the western side.

The following table gives the figures on which the wind-roses are founded:—

Number of Wind-rose.	Percentages.																
	N.	NNE.	NE.	ENE.	E.	ESE.	SE.	SSE.	S.	SSW.	SW.	WSW.	W.	WNW.	NW.	NNW.	Calms, &c.
1	29·6 3·0	22·9 3·2	14·6 2·9	5·2 2·2	2·4 1·5	1·0 1·5	0·3 1·5	1·5 1·7	0·3 3·0	1·5 3·0	... ...	1·5 2·0	1·5 1·4	0·3 1·5	1·6 2·5	7·1 2·2	8·7
2	6·7 2·6	21·1 4·1	43·6 4·3	15·6 3·6	5·8 3·0	1·2 3·1	0·7 3·4	0·5 2·0	0·6 1·0	... ...	0·5 1·0	0·6 1·0	0·1 1·9	... ...	... ...	1·0 2·0	2·0
3	14·9 3·5	41·7 3·6	23·7 3·4	5·9 3·4	4·9 3·5	1·9 3·3	0·7 2·3	0·4 2·7	0·5 1·0	0·1 2·0	0·9 1·8	0·1 2·0	0·4 2·0	... ...	0·2 3·0	1·5 2·5	2·2
4	28·9 2·8	18·7 3·1	20·0 3·6	8·8 3·9	2·9 3·8	... ...	0·2 1·0	0·2 3·0	2·3 2·7	1·4 3·0	0·3 1·5	... ...	... ...	... ...	2·7 2·8	11·7 2·9	1·9
5	10·3 4·1	24·9 4·4	34·6 4·4	16·9 4·1	6·3 3·5	... ...	1·1 1·7	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	4·6 4·8	1·3
6	8·5 4·0	16·2 4·1	25·4 4·2	23·1 4·0	15·4 4·3	4·9 4·2	1·8 2·4	1·6 2·2	... ...	0·2 4·0	0·6 3·5	0·2 4·0	... ...	0·9 1·0	0·1 1·0	0·6 5·0	0·5
7	5·9 3·1	25·7 4·3	41·0 4·0	11·6 4·3	9·0 4·3	2·2 5·9	0·4 6·5	... ...	... ...	0·3 4·0	1·4 3·8	0·5 6·0	0·2 2·0	0·2 1·0	... ...	... ...	1·6
8	9·5 3·1	30·8 3·4	22·7 3·8	12·5 3·9	11·4 4·2	0·8 6·5	1·2 6·0	2·0 4·7	3·5 3·5	... ...	... ...	... ...	... ...	... ...	... ...	0·9 4·0	4·7
9	7·2 3·8	23·3 3·0	39·6 3·6	22·9 3·5	5·3 3·0	... ...	... ...	0·5 2·0	... ...	... ...	... ...	... ...	... ...	... ...	0·3 1·0	0·3 5·0	0·6
10	8·1 3·5	19·6 4·2	20·8 3·7	11·9 3·7	7·7 2·8	3·1 3·5	2·2 2·5	1·1 2·9	1·3 2·8	1·3 3·0	4·0 2·2	1·7 3·8	1·4 1·5	0·4 4·0	3·5 5·2	5·9 3·3	6·0
11	7·6 3·1	16·2 4·4	14·9 3·9	16·0 4·1	17·0 3·7	8·5 3·7	2·5 2·3	1·6 3·0	2·3 2·8	1·8 2·8	1·1 4·4	2·0 4·6	0·7 2·6	0·1 4·0	0·9 3·3	3·3 4·3	3·5
12	6·9 3·7	17·3 3·5	25·1 3·5	18·0 3·9	9·3 3·9	3·4 4·3	2·1 3·1	1·4 3·3	1·3 4·5	1·4 4·8	1·7 4·0	2·3 3·7	4·4 3·2	0·4 4·0	2·0 2·0	0·4 2·0	2·6
13	4·8 2·7	17·7 3·5	26·1 3·3	20·0 3·6	13·3 3·8	3·7 3·9	3·0 4·2	3·0 3·0	0·9 2·0	2·8 3·8	1·1 3·5	....	0·4 3·0	... ...	1·6 2·6	... ...	1·6
14	8·3 3·3	13·4 3·3	25·7 3·7	12·7 4·0	5·9 3·2	1·8 2·8	2·6 3·5	3·4 3·9	5·5 3·2	2·4 2·6	3·6 3·4	0·7 2·7	5·4 2·6	1·4 2·8	1·8 1·7	0·7 1·3	4·7
15	15·0 2·5	18·7 2·4	28·1 2·8	7·7 2·8	1·0 2·0	... ...	0·7 4·0	... ...	1·0 2·0	... ...	0·7 1·0	... ...	1·0 2·0	0·8 1·0	12·0 2·2	7·0 2·9	6·3
16	13·6 2·6	10·3 3·5	19·8 2·9	12·4 3·4	5·2 2·5	4·0 2·1	4·2 2·0	0·8 2·7	1·9 1·6	0·4 3·0	2·7 2·1	1·0 2·6	3·6 2·1	3·7 3·2	4·9 3·1	3·4 3·5	8·1
17	12·5 3·5	10·0 3·2	14·5 3·4	9·6 3·6	4·3 3·6	3·9 2·8	2·9 2·9	1·7 2·4	3·5 1·8	2·1 2·3	2·3 3·9	8·6 3·8	7·4 2·8	3·2 2·9	4·6 2·7	4·3 3·5	4·6
18	12·6 3·1	19·7 4·0	6·3 3·5	5·7 1·8	1·5 1·5	3·5 3·3	6·1 2·9	2·0 4·0	0·9 2·0	0·9 4·0	0·9 4·0	5·7 3·2	8·8 4·8	3·8 3·7	6·6 3·7	7·7 2·5	7·3
19	9·4 2·7	13·6 3·4	19·2 3·1	7·1 2·8	4·8 2·5	0·4 4·0	2·4 2·4	0·3 2·0	3·9 3·2	0·7 1·5	3·0 3·6	2·4 4·5	3·4 3·0	5·3 2·8	3·8 2·0	4·3 2·3	16·0
20	10·3 2·8	13·8 2·4	11·5 2·8	6·8 2·5	2·7 2·2	5·1 2·9	5·4 2·3	2·4 2·5	0·8 1·5	0·6 1·5	2·7 2·8	5·6 3·0	5·5 3·7	1·4 1·8	10·6 3·5	6·3 2·5	8·5
21	11·8 2·4	3·8 2·9	3·7 3·0	4·3 2·9	4·0 2·1	1·8 1·7	3·6 2·0	0·6 3·0	1·7 1·4	2·7 3·1	6·2 2·7	12·3 4·0	12·4 3·4	10·5 3·0	8·9 2·6	8·0 3·2	3·7
22	4·1 4·0	5·8 3·4	5·0 3·0	1·4 3·0	1·6 1·5	6·8 3·0	3·2 2·0	1·2 2·0	2·4 1·7	6·3 2·9	6·9 3·1	4·8 3·5	15·7 3·0	12·9 3·2	10·5 3·2	8·2 4·3	3·2
23	13·5 3·5	4·2 3·6	2·1 2·1	2·5 2·3	4·7 2·4	1·5 1·5	1·6 1·8	0·9 1·5	3·8 1·7	1·4 2·0	2·5 2·2	2·8 4·0	6·6 3·5	14·2 3·9	12·6 3·4	14·6 2·9	10·5

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FOR THE MONTH OF
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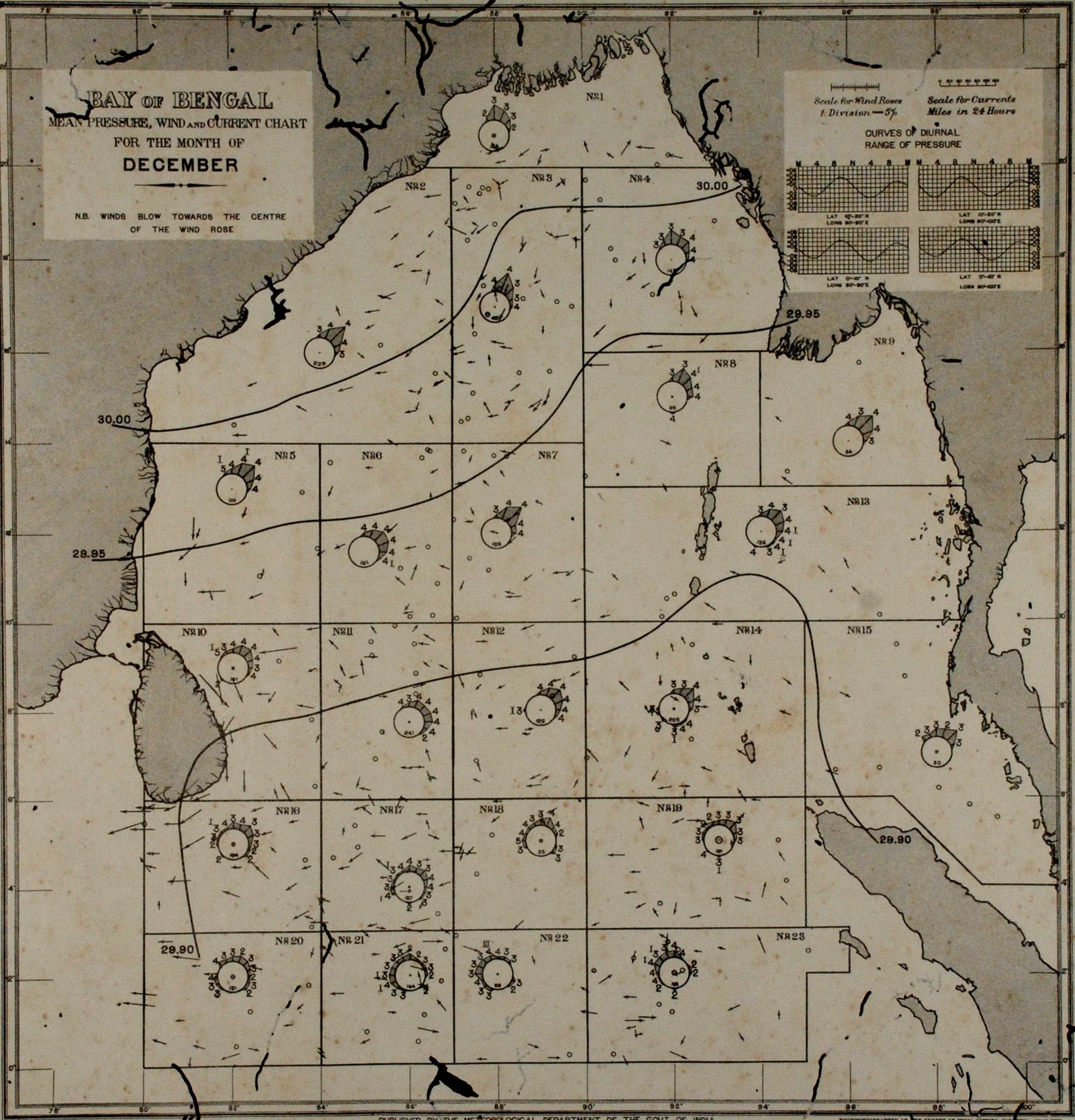

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